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FEBRUARY, 1939

Air view of Snap-on Tools, Inc. plant, Kenosha, Wis.

Finishing Operations on Snap-on Tools

The author describes herewith the most interesting phases of the polishing and plating operations employed at Snap-on Tools., Inc., Kenosha, Wis.

By CARLETON CLEVELAND

EARLY in the year 1920 when Snap-on interchangeable sockets were introduced on the market, a sharp turn-about in the wrench manufacturing industry resulted. Snap-on interchangeable sockets were directly responsible for drastically different methods used in production, assembly and maintenance operations in many lines of manufacturing. It is true that socket wrenches were not new even then, nor were detachable handles an innovation, but forged or machined sockets at that time consisted of brace handle and socket in one piece, thus, a separate wrench complete with handle for every size nut was required. Frequently, it was necessary for mechanics to have duplicate sizes, that is, wrenches having both long and short shanks. Aside from being unwieldy, such wrenches

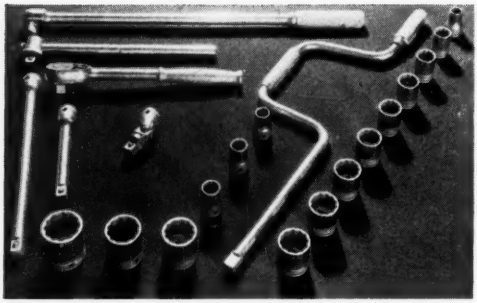

Fig. 1—A set of Snap-on tools showing both wrenches and sockets. This set has a chromium plated finish.

were expensive. The detachable sockets at that time were of the pressed steel variety which, when subjected to a hard pull, would split wide open.

Snap-on Tools., Inc. was one of the first wrench manufacturers to offer to the trade detachable sockets and handles of high quality steel, accurately machined and thoroughly heat treated. In addition to these qualities, the wrenches were guaranteed. The friction ball and spring were put to a new use, and the new Snap-on tools with the slogans "Ten Sockets, Five Handles" and "Ten to Do the Work of Fifty" were placed on the market.

In the early years, except for the purpose of rust-proofing, not much attention was given to finishing. Such details as better and tougher alloys to make possible the production of lighter, thinner and stronger wrenches were of prime importance. Then, too, it is more than probable that the trade would have scoffed at the idea of dressing up hand tools in pretty finishes as having no practical value.

Late in 1931, however, Snap-on Tools, Inc. gave serious consideration to chromium plating and full polishing of all tools. Sales appeal through the channels of the eye was not, contrary to general belief, the chief reason for a bright finish. It was realized that the bright chromium finish was a far more durable finish than any previously used on hand tools. It was soon evident that chromium plating the tools was no mistake and was of far more importance in creating a desire to own them than had at first been realized. The policy of combining the best appearance with greatest utility has continued to be the guiding light of Snap-on Tools, Inc.

In the early days, the tools were

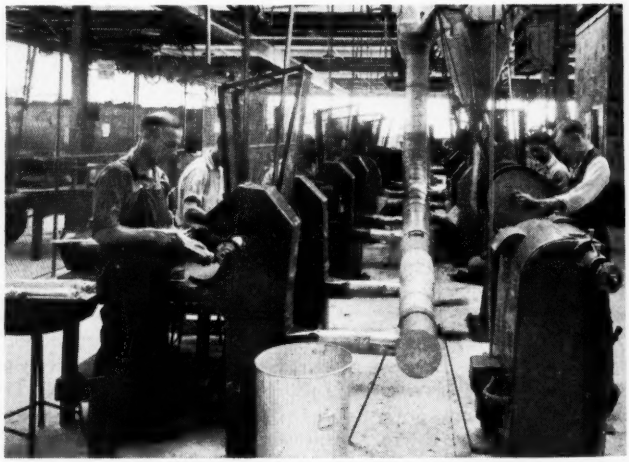

Fig. 2—A view of the polishing department showing the polishing units and also the dust exhaust and collecting system.

copper plated, nickel plated, nickel buffed, chromium plated and chrome buffed, but as new processes and more efficient methods were evolved it was found that certain of these operations could be dispensed with without detracting either from appearance or utility. The finish obtained on many of the workpieces is of such a lustrous beauty that one does not find it far fetched to draw a comparison between some of the smaller pieces and sparkling jewels.

The manufacturing and finishing of wrenches is much more complicated and requires more labor and many more operations than an inspection of the finished product reveals.

Although the general run of tools are finished in nickel and chromium, some cadmium and other finishes are applied to special jobs. In the manufacturing and finishing of more than 1,700 items, it is only natural that some of the tools follow one route through the plant while others follow another. Other tools, particularly those of odd shapes, are ground and polished before they are transferred to the plating department.

The polishing department is one of the most important departments in the Snap-on plant. A wide variety of tools of all shapes and sizes must be polished, and as a result, the polishing department is called upon many times to handle difficult types of work.

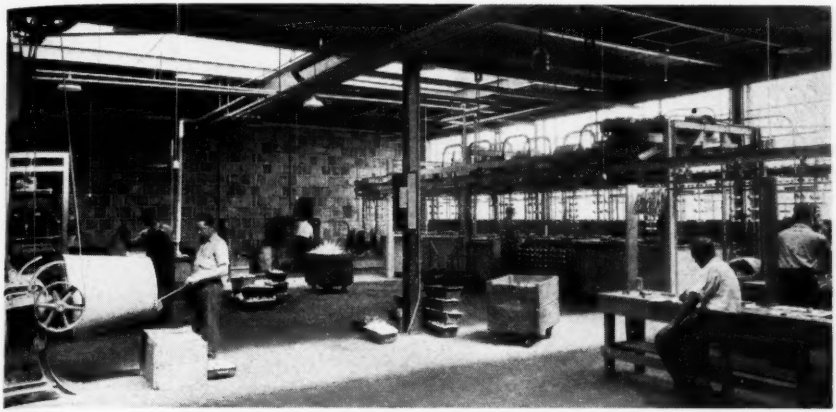

Fig. 3—Illustration showing the plating department. A Hanson-Van Winkle-Munning full automatic unit is shown at the right.

A battery of 12 L'Hommedieu polishing machines, as shown in Fig. 2, are used in the polishing department. Polishing dust is collected by means of a blower system and "Cyclone" which eliminates dust in the polishing department. Odd shaped pieces such as dolly blocks, body spoons, ratchets, hammers, panel cutters and tapered sockets are both ground and finish polished. Twelve-inch wheels are used on the polishing machine and the approximate speed is 2,800 r.p.m. A variety of polishing compositions and grits are used, depending upon the types of finishing.

An oil wheel is used for polishing to a high lustre and many of the aluminum castings are steel wire buffed to obtain a scratch brush fin-

Fig. 4—A view of the loading station of the chromium plating unit.

ish. Rough forgings are ground on a coarse emery wheel to remove flash marks before heat treating and are then transferred to the polishing department for final finishing. A minimum of four wheels is used on each polishing job, starting with No. 90 grit through No. 120, No. 150 and finishing with No. 200.

A Detroit Rex degreasing unit is used for cleaning oily and greasy parts prior to heat treating and the plating operations. The work is carried into and out of the degreaser by means of a balanced hand hoist.

From the polishing line, the work passes into the plating department as shown in Fig. 3, where it is racked in preparation for plating in a Hanson-Van Winkle-Munning full automatic nickel plating unit. Figure 4 shows a view of the loading station of the plating unit. The first operation of the nickel plating cycle is an alkaline cleaning for 5 minutes at 8 volts and 54 seconds with reverse current at 8 volts. The work is then given a hot rinse for 54 seconds, followed by a cold water rinse for one minute and 40 seconds. A 30 per cent sulphuric acid dip for one minute and 40 seconds follows. The work is then subjected to a cold water rinse for one minute and 40 seconds.

The nickel plating solution into which the parts are next conveyed is compounded according to the Harshaw Bright Nickel formula. Racked work-pieces can be seen in Fig. 5 as they pass through the bright nickel solution tank. Time required for the nickel plating operation is 20 minutes with 3 to 6 volts at from 20 to 50 amperes per sq. ft., depending upon the size of the article being plated. Approximately 0.0007 in. of nickel is deposited. The work then passes through a cold water rinse and then a hot water rinse.

Following nickel plating, the work is conveyed directly to the chromium plating department, where it is re-racked and immersed in an activated 5 per cent sodium cyanide cleaning solution for approximately 15 seconds at 8 volts. Two cold water rinses are then used before the work is placed in the chromium plating bath. The parts remain in the chromium plating bath for 3 minutes with the current at approximately 50 to 150 amperes per sq. ft. before they are removed and subjected to cold and hot water rinses.

The solutions in the plating department are under daily chemical con-

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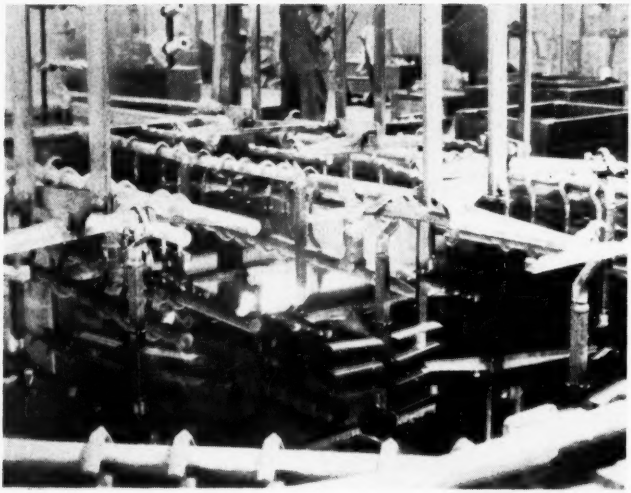

Fig. 5 — A close-up view of the automatic bright nickle plating tank showing the work as it passes through the solution.

trol and are kept up to definite standards at all times. The bright nickel solution is filtered at least once every 30 days through a Miller filter press which is provided for this purpose. The nickel tank is lined with Knight's vitrified stoneware and the acid tanks and plating barrels are Goodyear rubber lined.

Following the nickel and chromium plating operations, the wrenches are conveyed to the heat treating department, where they are placed in an airdrawn furnace heated from 350 to 700 degs. F. to remove hydrogen embrittlement.

Sockets that are chapmanized or carburized are copper plated on those sections where carbon penetration is not desirable. Some tools are chrome plated but not nickeled, as for instance, in the case of a hammerhead screw driver, which is made of high heat steel and cold drawn steel. Parts such as this are chromium plated prior to transfer to the heat treating department in order to keep the cold drawn steel from scaling or blistering during the heat treating. After heat treating, however, the hammerhead screw drivers are processed through the polishing and plating departments as previously described.

While the bulk of Snap-on tools are given a nickel and chromium finish, certain special tools are given other finishes. On some pieces, a cyanide copper bath or an acid copper bath is used. Cadmium plating is required on all government work and navy airplane work according to government specifications.

Items such as railroad ratchets and power, production and industrial tools

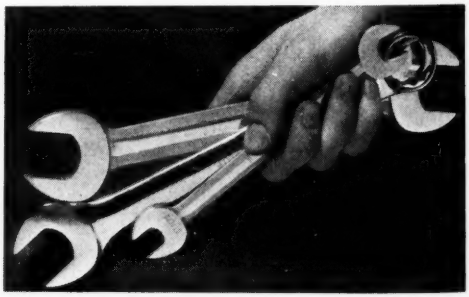

Fig. 7 — A set of open-end wrenches. The wrench in the center is chromium plated and chrome buffed. The other two wrenches have chromium plated heads with a buffed center strip and outer surfaces of dull chromium.

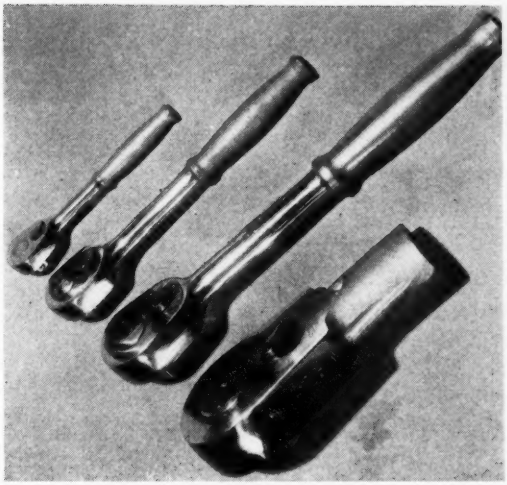

Fig. 6—A set of ratchet wrenches which have been chromium plated.

are given a rust preventative finish which is compounded according to a Houghton formula. This rustproofing operation is accomplished by dipping the parts into special tanks which hold the solution at approximately 200 degs. F. A gun metal finish which is said to be unusually durable is applied on a variety of tools. Many of the small steel wrenches and sockets are finished by the barrel burnishing method.

One of the outstanding features of the finishing operations at the plant is the extreme care exercised even down to the minutest detail. The success of Snap-on Tools, Inc. is due in a large measure to the fact that it was built on two principles, the principles being to always strive for the highest quality obtainable and to constantly render the trade a better service. The wisdom of this policy is attested by the company's steady and consistent growth.

Van Dorn Portable Electric Tools. The Van Dorn Electric Tool Company, Towson, Md., now has ready for distribution its new 1939 catalog of portable electric tools and accessories.

The new catalog covers the entire Van Dorn line of 114 different portable electric tools such as drills, tool chests, drill stands, hole saws, screw drivers, nut runners, tappers, saws, hammers, Lectro-Shears, bench grinders, portable grinders, heat gun, glue pot, sanders, surfacer, polishers, vacuum cleaner, valve seat grinders, valve lapper, valve shops, and valve refacers, as well as attachments and accessories.

Many new refinements in design and construction may be noted as well as several entirely new items, all of which is in accord with the company's policy of keeping in step with market requirements.

A copy of the new Van Dorn catalog will be sent free upon request.

Industrial Ovens, Dryers and Heaters. An unusually attractive 20-page booklet describing industrial ovens, dryers and heaters is now being issued by Gehnrich & Gehnrich, Inc., 32 57th St., Woodside, Long Island, N. Y. A number of heating systems for diversified processing requirements are illustrated and described. Detailed accounts of many standard and special applications of Gehnrich units are included. A copy will be sent free upon request.

"Smooth, Tough Floors Save Money." This is the title of a well-illustrated 4-page folder which is now being issued by Flexrock Company, 23rd and Manning Sts., Philadelphia, Pa. Many applications of "Ruggedwear" resurfacer for repairing worn floors are illustrated and described. The methods for the application of prime and the application of the resurfacer itself are also described. Copy free upon request.

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Finishing Touches to Metal Office Equipment

Metal office equipment that replaces wooden furniture because of its strength, safety, durability, and appearance, lends itself to modern finishing methods.

By Frank W. Curtis

IN KEEPING abreast of the requirements in steel office equipment over a period of years, the Art Steel Company, New York, N. Y., has developed a line of products that requires more than 2,000 different parts, ranging in size from small stampings to large panels. Manufacturing is handled in a four-story building, arranged so that as materials enter, the heaviest stampings are made on the lower floor, lighter stampings and other parts on the second, and assembly and miscellaneous manufacturing operations on the third. Finally, all materials are transported to the top floor, which is used exclusively for finishing operations.

While automatic straight-line handling of parts to be finished is usually preferable, this method does not always lend itself to existing conditions. Very often, the variety of parts and the quantities made decide the method of finishing just as it has in this plant. Finishing, therefore, is handled in either one of two methods — dipping or spraying — and the use of either of these two methods depends on shape, size, and quantity.

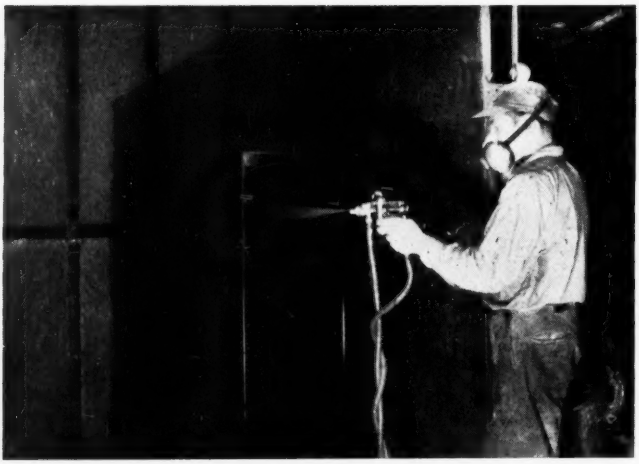


Fig. 1—Large parts, such as sectional file cabinets, are sprayed in one of the six spray booths as shown here.

Before being painted, all parts are cleaned to assure removal of grease and dirt. Those parts, which, due to manufacturing processes, are most likely to have oil-filmed surfaces, are

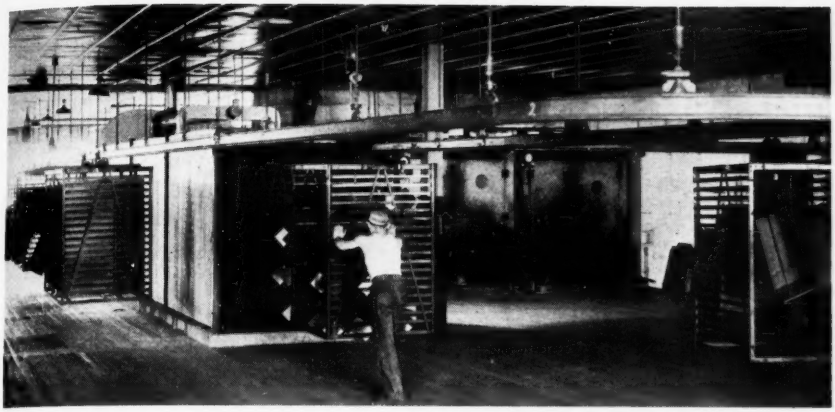


Fig. 2—Overhead monorail supported trucks are of the open-side and open-shelf type designed to accommodate large or small parts.

degreased in a heated trichlorethylene solution, while the others are washed with a cleaning agent such as carbon tetrachloride. This work is carried out in a separate room, in which products requiring refinishing are also routed. The latter are submerged for 20 minutes in a stripping tank so that all former paint is removed, then these parts are passed through the regular finishing procedure.

Most small parts are dipped in a tank of synthetic baking enamel, then hung on a chain conveyor that travels overhead along one side of the department. The conveyor is approximately 100 feet in length and is timed so that the work remains on it for 40 to 45 minutes. The point of removal is adjacent to the baking ovens so that the conveyor not only provides for normal dripping but also serves as a means of transportation synchronized with the floor layout.

Large parts and assemblies, such as letter files and cabinets, are sprayed in booths, of which there are six, also located close to the ovens. Fig. 1 shows a view of one of the six spray booths. Fumes from these are drawn off through a central vacuum system of the automatic type, connected to each booth with independent cut-offs.

For a large majority of the products, the finish is olive green, a somewhat standard color adopted for office equipment. This greatly simplifies handling, since the finishing procedure need not vary to any extent. However, when special colors are required, the only difference is that all parts are sprayed in a booth set aside for the purpose, then baked in a batch-type oven where the temperature and time elements can be regulated to suit the color or type of finish.

Natural wood finishes also are applied, to resemble French burl, walnut, mahogany, and oak. For this type of finish, the work is routed through a separate section of the finishing department which is equipped with several etched copper plates, graining inks, and rubber transfer rolls. From here, the parts, which constitute but a very small portion of the daily output, pass through the regular finishing procedure.

Baking is one of the most impor-

tant operations because this type of finish, its appearance and durability, all depend on the accuracy with which baking is carried out. In the past, several batch-type ovens were used, but these have given way to two possible time. The oven has automatic atmospheric control and the heater has automatic ignition and gas valves, together with safety devices for control of temperature and protection against failure. A motor driven ex-

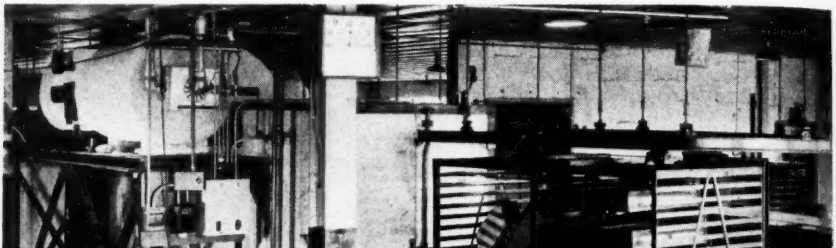


Fig. 3—Baking is one of the most important operations. Here is shown a continuous overhead track carrier oven through which all standard parts are passed.

Gehnrich continuous overhead track-carrier ovens of the tunnel type, which have not only increased the output but also have reduced costs. The loading end of the larger of the two ovens is shown in Fig. 3 and exit end is shown in Fig. 4. This unit is 45 feet in length, 5 feet in width, and 8 feet in height. Heating is by gas through an external atmospheric air heater, which may be seen at upper left in the illustration showing the outlet end of the oven.

This heater is connected to a blower that forces heated air through ducts from where it is distributed evenly to all parts of the oven. Together with recirculating ducts, this method of heating insures frequent air changes, ample dilution of oven atmosphere, and baking in the shortest haust fan draws off enamel vapors from the freshly loaded work before it reaches the higher oven temperature. This procedure tends to withdraw volatile vapors that might cause discoloration of the product or even increase the time required for baking.

Each end of the oven is provided with double swing doors, an overhead track inside accommodates eight trucks in tandem. The track connects with a complete system that travels past the spray booths, the drip conveyor and graining room, through the oven and then back to the starting position. The loaded trucks remain in the oven for 42 minutes. The baking temperature is 320 degrees Fahrenheit.

The trucks are made in two styles, one of the open type to accommodate

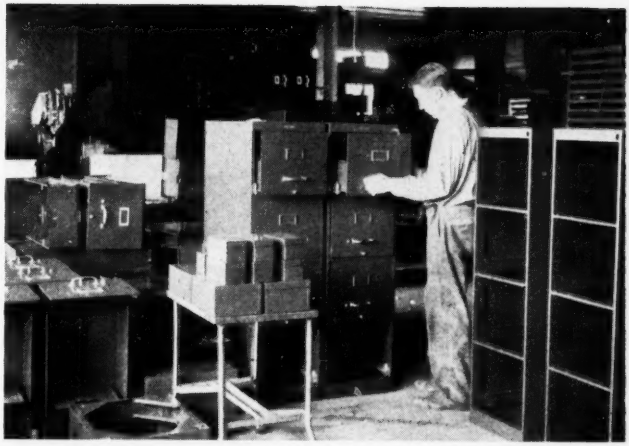


Fig. 4—This illustration shows one of the ovens. This unit is 45 ft. long and is heated by gas through an external atmospheric heater. The oven is controlled automatically.

large pieces, and the other of the shief type so that various size parts can be loaded by merely changing the position of supporting shelves or bars. A contrast of these trucks is shown in Fig. 5, both of which are about to be conveyed into the oven.

Inspection of finished products is done after baking. The work is carefully examined to make sure that the enamel has been properly applied and that there are no defects. At this point hardware and metal trim is applied and the finished units are transported to the shipping room. A group of metal equipment made in this plant, at the point of final inspection is shown in Fig. 4. The products include letter files, drawers, cabinets, wardrobes, tables, typewriter stands, lockers, trays, security boxes, display racks, magazine stands, and many other items, all of which have appeal for the modern office because of their appearance and space-saving features.

"Willson Protecto-Shield." This is the title of a four-page bulletin which is now being issued by Willson Products, Inc., 271 Thorn St., Reading, Pa. This bulletin illustrates and describes a new type of shield which is designed to fit over correction spectacles for workers engaged in light grinding and polishing operations. A copy of this bulletin will be sent free upon request.

Fig. 5 — A thorough examination follows immediately after the finished parts leave the baking oven.

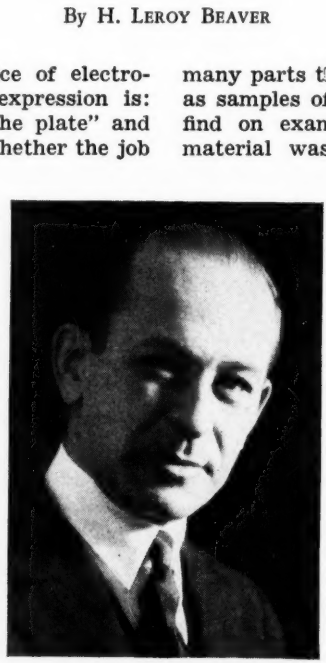
Barrel Finishing of Metal Products

Factors in the barrel processing of basis metals prior to plating.

By H. Leroy Beaver

IN the general practice of electroplating a favorite expression is: "Let us look beneath the plate" and in so doing determine whether the job has been well and properly, or poor and indifferently performed.

In the barrel preparation of metal products, whether ferrous or non-ferrous and whether stampings or castings, we must go a step further than the above and try in every way possible not only to determine what is on the surface of the metal part but also and perhaps even more important to determine insofar as we possibly can, what lies beneath the surface of the base material itself that might contribute to either success or failure of the electroplated surface.



H. Leroy Beaver

The first factor is the discussion of parts made from sheet or strip steel, and the question "Why does it seem impossible for us to secure a bright high finish to our part by barrel burnishing prior to plating?" On many parts that have been submitted as samples of the finish obtained, we find on examination that the basis material was annealed entirely too soft to permit a high color being obtained, and soft materials will not respond to the burnishing treatment in the same manner as those of greater hardness. The answer generally is to change the raw material from "dead soft" to either what is designated as "half-hard" or "Number 2 Hardness" and this generally works a solution to the securing of a high white color. One of the places where the variation in finish that is secured by barrel operation is most marked is in the production of steel balls for bearings. There are times when, due to mill faults or else heat treating faults, that the ball blanks come to the lime polishing stage which is done in barrels, on completion of the operation and the balls come into the inspection department,

there will be found balls that are designated as "dead soft" or "part soft" and this degree of the inspection is determined almost solely by visual inspection and is clearly shown by the dull, dead appearance of the surface of the soft or part soft balls when compared with the properly hardened balls that appear on the same inspection slate, and it is also clearly determined by the fact that the soft or part soft balls have a fine peined surface appearance which in some ways might be confused with what is known as "orange peel" surface on a piece of strip steel formed into a part. Indeed we have seen burnished steel stampings where it was definitely decided that they were made up from orange peel surface raw material when as a matter of fact they showed all the surface indications of having obtained their appearance in the operation of the burnishing barrel itself, the effect being caused by too soft material coupled with too high an operating barrel speed.

Coming now to the strip steel having an orange peel surface and which has been formed into stampings the question is "What can we do to obtain a smooth, even surface prior to plating, and what kind of a barrel and what abrasive materials shall we use to cut down and even out this mottled appearance?" Of course, the best answer is to change the grade of raw material so that the orange peel surface is not present in the first instance, or if it is not present in the original strip but is caused by too soft metal and too high barrel speed, then change to harder metal. Barrel finishing as a part of production is not an economical process where we undertake to grind down with a complete overall ground finish, a part that should be smooth in the first instance before forming, because even after the grinding operation it is then re-

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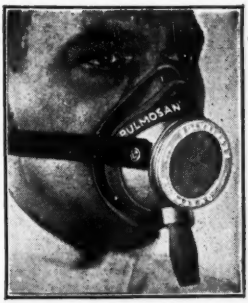

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quired to barrel burnish and the time required to reduce the matte finished ground surface to a high white color and clear lustre for plating is entirely too long and too expensive, and cannot profitably be done except in a very few isolated cases where added soft material is required due to the intricacies of the forming operation itself.

Then, too, in such a cutting down operation where a long operating cycle is required the form of the part is altered somewhat, because though theoretically in grinding down operations the surface is removed in exactly the same volume over the entire surface of the part, this is not precisely true, because it will be found that the edges will grind away faster and in greater proportion than the plane surfaces of the parts. In some cases by the time the plane surfaces reach the proper degree of smoothness, the edges are reduced to knife blade proportions and in most cases requiring rejection of the parts.

And, so we repeat, that if a surface of a stamping is so irregular as to require a cutting down operation, by all means change the grade of the raw material and purchase a smooth finished surface material that will not require such an operation after forming. The readers of this series may well understand that in a course of papers covering such a wide field of operations that hundreds of samples of parts have been submitted for our opinion as to what would be best to do to by way of improvement, and we must comment on the vast number of pieces submitted where apparently in the purchase of the raw material from which the parts were formed, little or no attention has been paid to the important element of "grain size" of the raw material in the first instance.

The same mills that produce average or ordinary strip can also produce strip of finer grain size, and we predict that the time is coming when the Standards Committee of the American Electroplaters Society will write a definite specification covering this important element of the proper grain size of steel for plating purposes, a subject that was so ably discussed in a previous issue of PRODUCTS FINISHING by Mr. Frederick Fulforth wherein it was shown by photomicrographs the great advance made in this important phase and which amply illustrates that "it can be done" if the buyer will i n s i s t strongly enough.

While it is true that steel of fine and even grain size costs more than "run of mill" strip, at the same time the operating cycle in the barrel operation is reduced and buffing is eliminated to such an extent that it really brings the cost of the finer strip to a lower base price than the ordinary kind even though we did not take into consideration the far enhanced appearance of the finished product.

The next thing of importance that stands out in the samples that have been submitted is "die marks." The question "Is it possible to get rid of these die marks by a barrel burnishing operation?" We say no in practically all cases, because a change in the die to eliminate the die marks would be a far more sane procedure because to eliminate such marks, at least such as appear on samples that have been submitted would require an "overall" grinding down operation on strip material, a proceeding that is neither practicable nor economical and does not work for a finely finished part.

In some parts, angles have been drawn so sharply in the die design, that the formed piece is stretched beyond its limit of elasticity or plasticity with the consequence that tiny

cracks are formed along the entire length of the angle section of the part. These cracks are of varying depth and to effectually grind them out in a barrel process using abrasive with some weight carrying medium would be most impractical and a change of die design to soften the acute angle that causes the condition is always indicated. Then, too, such cracks that form when the material is forced beyond its elastic limit present much the same class of problems as we find in sub-surface porosity and slag inclusions, both of which present their own difficulties to the plater. As we have so often said, if the matter of final approval of a design is first submitted to the plater many of these difficulties would not appear because the plater would immediately sense the points in design where forming problems might arise and where the problem of proper deposition of the plate that would permit final complete color buffing would be important, and all of this could be guarded against, but we find in looking into many of these cases that the plater is never consulted, the design is worked out and approved by the sales department on the basis of appearance and without regard to the manufacturing difficulties that might be encountered along the way. We can successfully burnish into and clear angles with as small a radius as $\frac{1}{32}$ in., but it would be far better in designing a part if no angle were to be permitted smaller than $\frac{3}{32}$ and, if possible, preferably $\frac{1}{8}$ in., and so we may consider the problem of die marks and angles as being on a par insofar as their importance in operating procedure is concerned.

We come now to two factors that perhaps have in them the possibility of more trouble for the plater than any of the factors we have heretofor outlined and they are found in

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the elements of slag inclusion and sub-surface porosity, and it is these two factors that are also met with in the cheaper grades of materials and we could almost classify them as one difficulty instead of two. We know, of course, that we cannot plate over a hole and yet in some cases an area of sub-surface porosity only shows as a very tiny pin hole on the surface. Slag inclusions can show up in the same way, but neither of these defects may be considered in the same sense as the ones previously discussed because the former being for the greater part mechanical defects, these latter are of a different character.

So far as steel parts are concerned, there is little that we can do by way of barrel operations to cure slag inclusions or sub-surface porosity, and it is only in the field of the more plastic metals such as brass or copper that barrel burnishing or barrel operation can play an important part in the elimination of such difficulties. These more plastic metals can be worked in a barrel processing to a far greater extent than the ferrous metals, and very often and especially in cases of sub-surface porosity we can iron the holes completely closed so that plating can be satisfactorily accomplished. This, of course, if previous operations are carried out in such a way that they will permit of the final closing operation in the barrel process and this can be accomplished far more frequently in the case of non-ferrous castings than with strip material. There is no question but that there is a marked lowering in the number of rejected pieces in non-ferrous castings where a barrel operation is used to smooth out the surface prior to plating. Parts that on casual inspection will seem to pass all requirements, will, when given an acid dip show very marked defects, and if such parts are given a barrel operation prior to plating, many pieces that would otherwise be thrown out may be reclaimed.

Defects are not so clearly seen on rolled strip as on castings because here the pin holes that generally mark a sub-surface area of porosity are rolled shut, or apparently so and very often do not show up until after the part has been plated and failure has resulted in the plate. This operation of closing pores and scratches by the barrel process is a matter that deserves the earnest attention of everyone interested in the electrodeposition of metals because we believe that if the proper research is devoted to it, that we can eliminate the process of acid dipping by using a barrel operation in its stead.

In bright dipping castings and where sub-surface or slag included areas are encountered there can be no question but that the acid will penetrate to the depth of the defect in the surface of the material, and then if a barrel burnishing operation is included as a part of the operating cycle prior to plating, the soap used in the barrel operation being alkaline will oppose the remainder of acid in such areas with the result that gases are formed and the plated surface will almost invariably fail. The same is true where parts are formed and where die-forming grease or oil penetrates into such areas and they are later plated over without being completely and properly cleaned that failure of the plate almost invariably occurs.

The matter of barrel cleaning, or should we say cleaning metal parts by the barrel method never impressed us so forcibly as it has since we received an outline of the English procedure of cleaning parts prior to plating. While it is true that they use bright dips on non-ferrous parts, they

do not content themselves with a simply neutralizing dip and then a rinse following dipping, but all parts that have been acid-dipped are then placed in oblique tilting type barrels and run in a 10 per cent sodium hydroxide solution for a sufficient time to assure complete neutralization of the acid by the alkali, and this barrel operation is continued until the parts are clean even though as many as three changes of cleaning solution are used. From some of the cleaning operations we have seen in some plants we might feel constrained to recommend the English barrel cleaning method to the serious attention of a lot of platers, because we are convinced that it has possibilities, and within the past month we have done some experimenting with it in one of our small laboratory oblique barrel shells. In this we used bright dipped barrel finished brass castings that were supposedly clean and ready for plating. These were rejects and naturally had surface defects such as the sand inclusions and sub-surface porous areas we have been discussing. It was thought that an acid dip, followed by a dip in alkaline solution and then a rinse, would effectually complete the cleaning cycle and have the parts ready for plating.

Half of the quantity of parts were laid aside, and one-half were placed in the small barrel and operated in a solution of sodium hydroxide 10 per cent for twenty minutes. We then took two beakers placed one-half of the parts in each and the same type of soda solution and brought them to a boil. On the parts that had been bright dipped neutralized and rinsed, there was a marked deposit of silt on the bottom of the beaker as well as a fine film of grease on top of the water. On the parts that we had run in the barrel for twenty minutes in the soda solution, there was a very faint film of sediment and no oil film whatever. If parts that are difficult to plate when small in size can be successfully operated upon in a barrel

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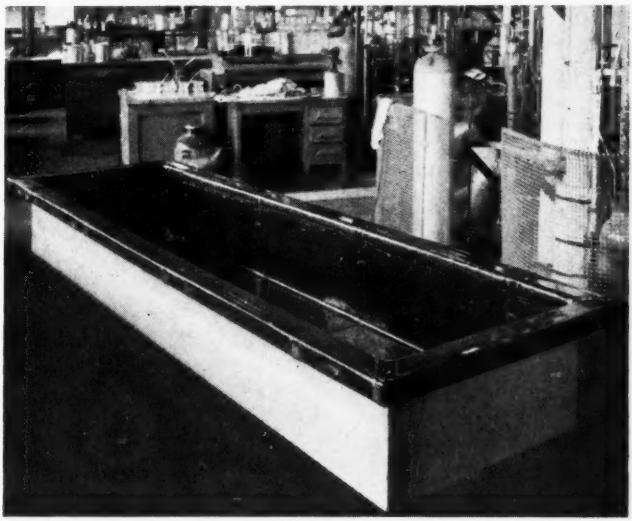

Illustration showing a tank lined with sheets of Koroseal. This type of lining requires the use of heat-sealing methods and is capable of withstanding temperatures up to 150 degrees F.

(Photo Courtesy The B. F. Goodrich Company)

and electroplated it would seem to follow that electro cleaning could also be widely applied to the problem of cleaning prior to plating. When production is at its peak and bright dipping followed by barrel burnishing is employed as a part of the cycle, we are not sure but that vast quantities of parts are not completely neutralized and when the acid and alkali combine, as they easily could in such operations where porosity is considered, this could easily give rise to a condition where adherence of the plate would become a problem.

We are planning now on continuing our research along the line of barrel cleaning prior to plating with the thought in mind that by the selection of the proper polishing abrasive to be used in combination, that there is a possibility that in at least a great many cases bright dipping with acid can be eliminated and a thoroughly cleaned part presented to the plater on which to deposit his plate.

"The Meaning of the RLM Label." This is the title of a new book on modern lighting conditioning now being issued by RLM Standards Institute, 20 N. Wacker Drive, Chicago, Ill. Into the book has gone the composite experience and knowledge of the engineering departments of leading manufacturers of lighting reflectors associated in the RLM Standards Institute.

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Heavy Chromium Plating to a Given Thickness

Important phases of heavy chromium plating such as adaptability, racks, and preparation of work are discussed by the author.

By E. F. INGERSOLL

DURING the past ten years the use of heavy deposits on machine tools and other articles has proven that a much wider field exists for this type of plating. However, one of the chief obstacles to be overcome is the reluctance of many potential users of this process to give it a trial on their products. One of the reasons for this can be attributed to the fact that, when this process first came to their attention they had samples plated by many platers and jobbers who, not thoroughly versed in the process, failed to produce the grade of work demanded. With the results it failed in its purpose. Today, however, many of these same platers and jobbers understand the process thoroughly. It might be said that for successful deposition of "hard" chrome, 90 per cent of the success depends on the operator's skill.

Field and Adaptability

In a brief summary of the field of uses for such plating we could include the following: drills, reamers, punches, stamps, molds, gages, sleeves, cams, gears, cutters, slotters, thread rollers, dies, guides, undersize parts of many uses, reclamation of expensive tools and many other uses which are continually coming to our attention. Its use does, however, call for quite some study of the performance desired and methods to attain it.

We know, of course, that chromium is a very hard metal. On Moh's scale of hardness a diamond has a hardness of ten, while chrome is rated as nine. In addition to its hardness, chrome has a very dense crystalline structure.

When we deposit chrome on steel we must remember we are covering a softer metal with a harder one. For that reason if we desire a very hard surface we should first harden the steel to desired hardness. It goes without saying that the harder our base metal, the harder will be our finished product. Nevertheless, on many products we have to work within a given range for hardness in order to secure toughness as well as hardness.

Another thing to be kept in mind is the different co-efficients of expansion of the base and plated metals. This is very important in this phase of plating, as the tools, etc., will no doubt work at times at high temperatures. It can be seen that here we must have an excellent bond between the two. If study is given to the operation desired and the thickness of chrome determined for most efficient operation,

we can secure successful results.

The dense crystalline structure of chrome is one of the foremost reasons it has proved so successful in plating molds for many plastic materials. Formerly much trouble was experienced with the materials sticking to the molds, which resulted in reduced production and many rejects. Thanks to chrome, a great deal of this evil is now done away with. The deposition on molds does not have to be as heavy as some of the other products we will mention. Usually from five one hundred thousandths to two ten thousandths is deposited on molds. Due to the complicated design of many such molds, it requires special care to get a uniform deposit. Auxiliary anodes are employed to a large extent on the more complicated and deeply recessed molds.

This dense structure of chrome is also the reason that free chip removal is obtained with drills and cutting tools. The chief surfaces to be plated on these parts are the lead surfaces or the lead of the cutting edge. Figure 1.

In drilling some non-ferrous metals, such as copper, and many plastic materials, chrome plated drills have been found to give from five to eight times the durability of ordinary drills. In one instance, a manufacturer of wooden jewelry cases experienced much trouble with trimmers or cutters which were used to trim the glued corners and edges. After having a group of cutters chrome plated, he reported their life increased by 175 per cent.

Many of the larger manufacturers have now installed plating departments solely for this type of work. This is especially true where large numbers of gages are used. They have found that it is economical as well as obtaining greater accuracy on the gages.

On cams, guides, and so on, which are subject to great pressures and much friction, chrome will give a harder and more durable wearing surface.

All pieces upon which one thousandth or more of chrome is to be deposited should be finished ground undersize enough to allow for the thickness desired. After plating to desired thickness, which should be from

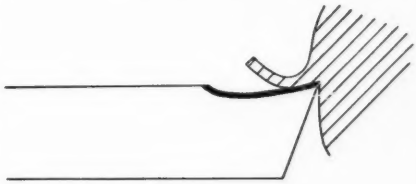


Fig. 1—The heavy-lined surface is chromium plated and gives this type of cutting tool a hard, tough cutting face and at the same time assures free chip removal.

one-half to one thousandth over the finished measurement desired, the parts are reground with a very fine stone to exact dimensions. This final lapping or stoning being necessary due to the fact that the part, upon coming from the plating solution, will not have the same thickness of metal deposited at various points of measurement. The variations will not be great, but there usually is some difference.

Racks

Here again we have a proposition that calls for serious study. As the current densities involved are high, the rack must be so constructed as to sufficiently carry the necessary amount of current.

Among other things to be taken into consideration of design and construction are: simplicity, size, cost and adaptability to other kinds of work. The racks should preferably be

of copper because of its higher conductivity. If they are to have spring contacts, these are usually made of phosphor-bronze. In estimating the size stock to be used, the total area, in square inches, of work and rack exposed to the anodes must be determined. After this has been computed, the following formula may be applied. Current density in amperes per square inch x area in square inches, divided by two thousand equals the cross section area in square inches of stock to be used.

$$\frac{\text{C.D. amps./in. x A in sq. in.}}{2{,}000} = \text{Cross section area in sq. in.}$$

Example:

If we are plating small parts each with an exposed area of fifteen square inches and we wish to plate ten on the rack, at two and one-half amperes per square inch. First, we have 150 sq. in. of surface.

$$\frac{2.5 \times 150.}{2{,}000}$$ is .1875 sq. in. of cross section or ½ x ⅜ stock

On racks for some types of work we may be forced to employ the auxiliary anodes or in reverse cases we may have to use guards or "thieves" to protect sharp projections.

The following paragraph is from Research Paper No. 131. U. S. Dept. Comm. Page 35, Paragraph 3. by H. L. Farber and W. Blum:

"It has long been the practice of electro-platers, especially when producing thick metal deposits as in electro-forming, to attach metal wires or rods to the cathode, near those parts which otherwise tend to receive cessive current densities and 'burnt' deposits. The wire serves to attract part of the current and, in the language of the old-time platers, acts as a 'thief.' This principal has been very successfully applied in chromium plating especially on small parts having sharp projections on which a 'burnt' deposit is likely to form.

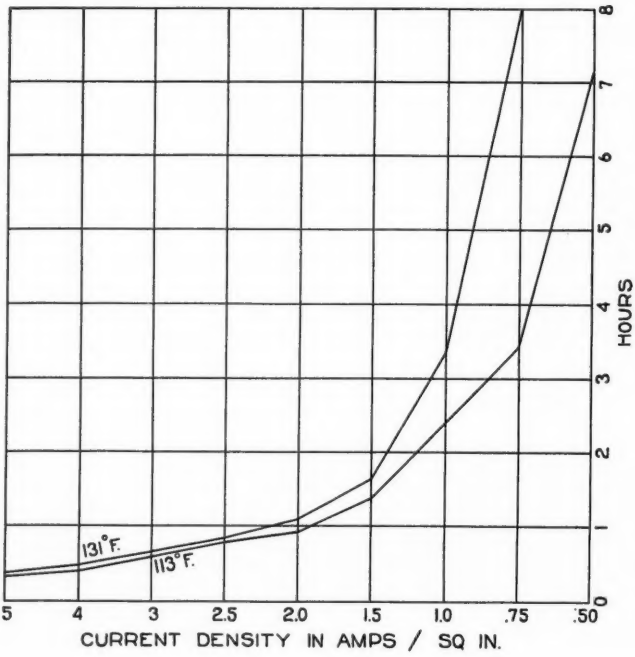
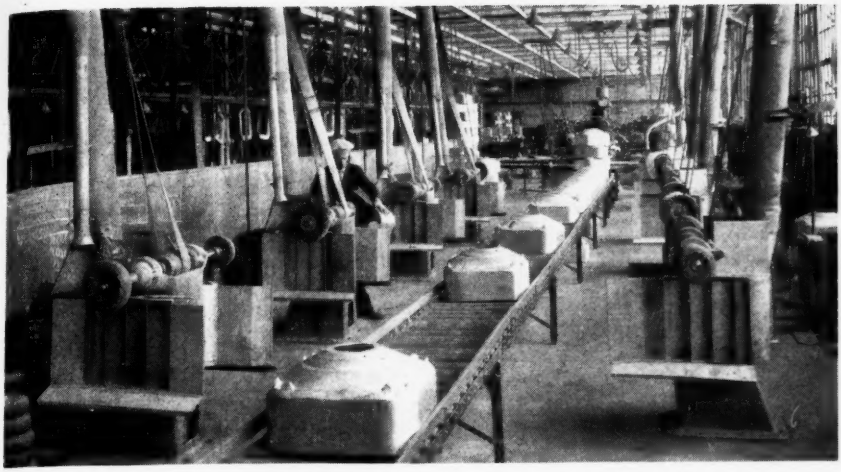


Fig. 2—The plating time required per thousandth of an inch thickness is plotted on this graph for temperatures of 113 degs. F. and 131 degs. F.



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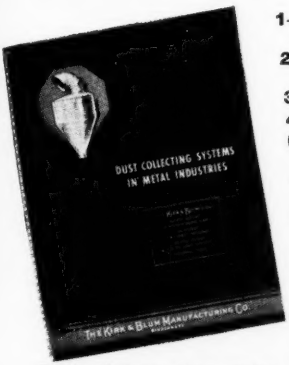

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When these articles are hung on metal racks in such a way that the exposed points are adjacent to a metal wire or rod which forms part of the rack, or to other parts of the cathodes, the current density is made more uniform on the articles, and complete plating can be accomplished without burning on the projections. In some cases a wire cage or basket is attached so as to surround the projecting points."

Auxiliary anodes are generally made of lead strips or wires of such size to obtain necessary anode area. They must be attached to the rack with an insulating material such as porcelain, micarta or any good insulating material. Such attachments should, however, be used as seldom as possible, as they complicate the design and raise costs.

Racks are generally insulated with four or five coats of a good acid resistant lacquer or paint directly on the metal or over a specially prepared masking tape. Time should be allowed between each coat for thorough drying. When this insulation becomes chipped, cracked or peels off, the rack should be thoroughly reinsulated.

Preparation of Work

Measurements of surfaces to be "hard" chrome plated should be as accurate as possible, as this will give a more accurate control over the current necessary for a successful deposit. A good set of micrometers are necessary for accurate measurements. Threaded parts or knurled areas that are difficult to measure accurately, may be figured to approximately the true area by multiplying the overall measurement by two and one-half. Example:

A plug gage has a knurled section in the center that is two inches long by three quarters of an inch in diameter.

Pi x .75 x 2. x 2.5 = 11.77 sq. in. of knurled area.

Many articles to be plated in this manner must be stopped off or insulated in certain portions, that is to say, certain parts are desired to be left unplated, or on some articles, there is only a small area on a large article to be plated. In these cases the surfaces that need not be plated are stopped off or insulated. Before the areas are lacquered or insulated the article must be thoroughly cleaned in an alkali cleaner or a degreaser. After the parts are cleaned they should be allowed to cool sufficiently before insulating. The parts should, if possible, be racked before insulating also.

Three or four coats of the insulating material should be applied to areas not to be plated, with sufficient time allowed between each coat for drying. If the piece should be lacquered while too hot, the insulation will blister and peel while in the plating solution. After parts are insulated on the desired areas, any insulation that has been applied to the areas to be plated must be removed by thinner or by cutting. The rack of work is now ready for final cleaning and pickling. Rack should not be immersed in any cleaning solution, as it will attack the insulation. Instead the work should be swabbed with solution and immediately rinsed in cold water.

The pickle used is a sulphuric acid and water solution made up to read 50 degs. Be. The solution should be kept within plus or minus two degrees to the above reading. This is contained in a stone ware or lead lined tank. If the department is damp, as most plating departments are, some trouble will be experienced by the solution absorbing moisture

from the air, which will result in a dilute solution. To overcome this, the solution should be kept tightly covered at all times except when in use. The rods on which the lead cathodes are suspended should be tinned or lead coated to prevent corrosion. Anodes should be removed at frequent intervals for cleaning. The work is pickled anodically, using lead cathodes at a current density 50 amperes per square foot.

On steel that has been carburized or steels that have been hardened very hard, the action will be slower than on steels ordinarily encountered. These hard steels upon removal from the pickling solution will occasionally have a mottled appearance, they should be returned to the pickle and given an additional 7 or 8 minutes in the solution. Ordinary steels will pickle to a light grey color in about 5 minutes. Any dirt or grease spots on the article will show up on removal from the pickle. If this happens the article should be recleaned and repickled. The parts now through this operation should be rinsed in three clean cold running waters so as to remove all traces of chromic acid.

Plating Procedure

The rack of work upon being placed in the plating solution may be allowed to remain without current until it attains the temperature of the solution, which should be 131 degs. F. The solution most commonly used for this type of work is the 250 gram per liter chromic acid solution, with a sulphate ratio of 100 to 1. The current densities used, for production of hard chrome, are commonly between 2 to 3 amperes per square inch. By the use of these densities, along with a corresponding temperature regulation, a more dense crystalline structure is obtained. It is, of course, understood that an increase in temperature must be accompanied with an increase in current density.

It has been found by experimenta-

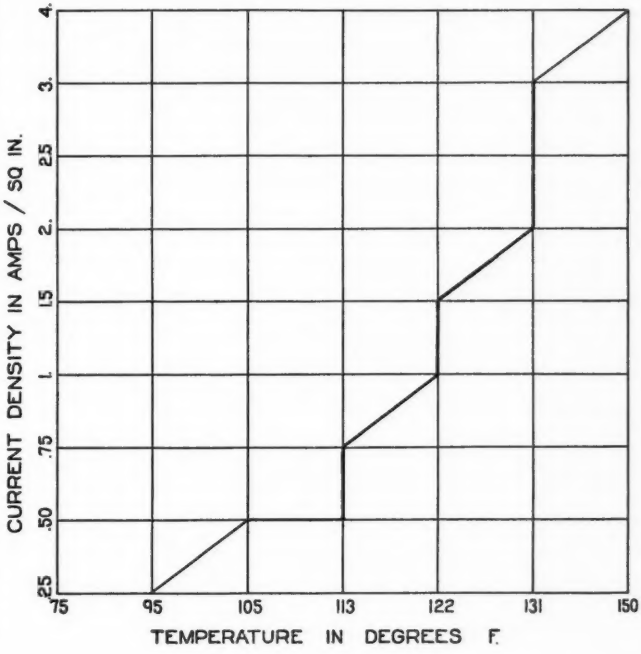

Fig. 3 — A temperature and current density chart for heavy chromium plating. The heavy lined area is the most suitable plating range.

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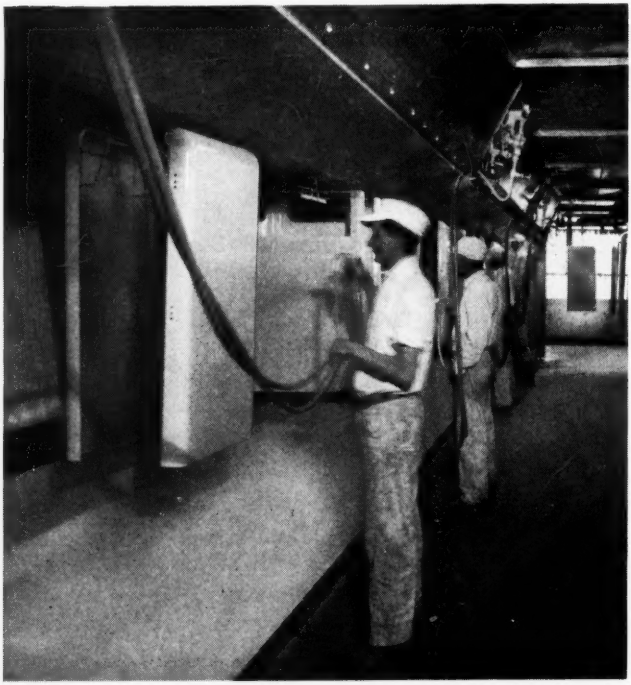
tion that the most efficient temperature range for this kind of work lies between 113 to 131 degs. F. If we increase the temperature without a corresponding increase in current density we increase the plating time necessary for a given thickness; if, however, we do increase the density we will greatly reduce the time for the same depth of plate. After many experiments, it was found that for maximum hardness and ease of manipulation, with a temperature and current density as described herein, most consistent results were obtained.

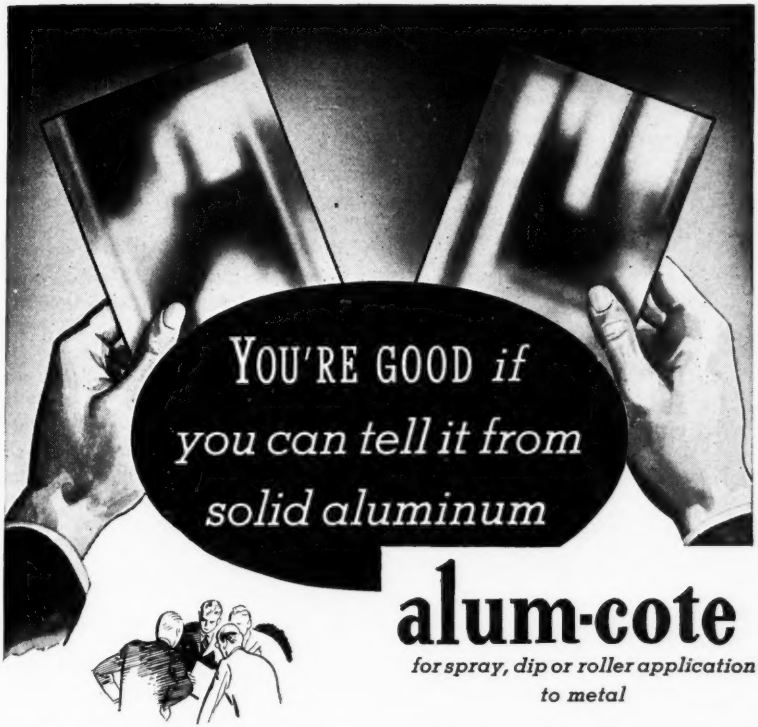
The plating solution should be kept exceptionally clean for this type of work, as any foreign matter will ruin many dollars worth of work.

In doing some types of articles the tank may be partitioned off with glass into several separate compartments, each with individual controls and individual connections. This method gives a finer control over current densities.

It can be noted on the graph in Fig. 2 that when current densities below 2 amperes per square inch are used, the time of deposition increases rapidly. It will also be noted that above 3 amps the time only slightly decreases. The reason that densities over 3 amps are not recommended is the danger of "burnt" deposits and of the deposits cracking on sharp corners. Also the usual chromium plating equipment is not designed to adequately heat solutions to over 150 degs. F., which would be necessary if we went much higher than 3 amps per square inch. The most successful



Newcomb-David Tube Type Spray Booths in the plant of the Norge Division of the Borg Warner Corporation. The conveyor line carries doors for refrigerators manufactured by this company.



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densities and temperatures are noted in Fig. 3.

Finished Work

Upon removal from the solution, the work is rinsed in the usual manner and allowed to dry. The deposit should be smooth, hard and nearly as brilliant as decorative chrome plate. After the work has cooled to room temperature, measurements may be taken. These can usually be taken without removing the work from the rack. If the appearance of the article is satisfactory and the thickness of metal is as desired, one more test should be made; the article should be filed in one spot with a sharp file. If the deposit is at maximum hardness, the file will leave no marks. If the article or work is undersize or under the desired diameter, it may be returned to the plating solution. However, if this has to be done, care must be taken, as the work will have to be repickled. This should be a very light etch, as the pickling solution will remove deposited metal very rapidly if allowed to remain any length of time. Usually 30 seconds will be sufficient time for this repickling. After thorough rinsing, replace in plating solution without current, until temperature of solution is attained; this will take about 3 minutes. When current is switched on it should be as low as possible a current density; this should be gradually increased until desired density is attained.

When work has been plated to the desired thickness and measurements are correct, it can be removed from the racks and any insulated areas stripped off, after which it should be oiled with a light oil. A final test usually employed on this work, provided, of course, it is a piece suitable, such as a plug gage or any solid part, consists of placing the article on a steel plate or block and give it several smart blows with a light hammer. If there are any defects in the deposited metal it will chip or crack.

In stripping any hard chrome rejects, the usual methods are not commonly employed. The strip most widely used is a strong alkali solution, with reverse current. Soda ash, sodium bicarbonate or lye used in concentrations up to 15 ounces per gallon removes the plate without any attack on fine machine tools. The work is made anodic, being suspended with iron wires or hooks. Steel cathodes are used with a current density of 50 amps per square foot. This strip will have a tendency to raise in temperature when in use. This should be counteracted by installing cooling coils, or in small installations the sides of the tank or container may be sprayed with a cold spray. Care must be taken when stripping work to be replated, as every trace of chrome must be removed to secure a successful deposition. If any spots escape detection upon removal from the strip, they will be immediately noticed when the work is repickled, before replating. The chrome, upon removal from the pickle, will be a dark reddish brown color.

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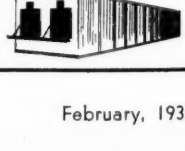
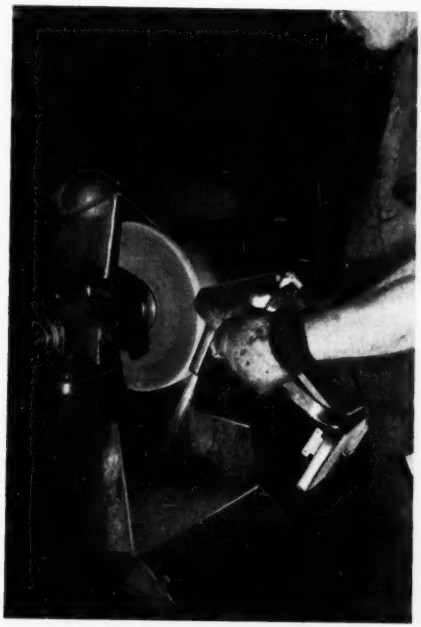


Non-Glazing Abrasive Grain for Production Polishing

By COLLINS L. HALL
General Abrasive Company, Inc., Niagara Falls, N. Y.

A STEADILY increasing demand in the field of metal polishing has been for an abrasive polishing grain that would eliminate wheel glazing or "loading" and this demand has centered principally in the field of rough polishing. In order to produce an abrasive polishing grain of this character that would retain its cool, fast-cutting qualities and not dull because of glazing required radical changes in the basic structure of the abrasive. It meant that a higher crystalline aluminum oxide content was needed to permit greater friability than had been furnished in previous abrasive polishing grains. To make an abrasive grain of this type meant starting from the bottom and building up, rather than to make refinements in existing polishing grains.



Uniform polishing by production methods is achieved through the use of non-glazing abrasive grain.

In formulating an entirely new abrasive grain, it is necessary to first select a type of crude Bauxite of proper chemical analysis. After a careful selection of the ore showing this required chemical analysis, the Bauxite must be calcined, crushed and otherwise prepared for fusing in an electric arc furnace. The uniformity of the resulting ingot, first assured by the unvarying quality of the Bauxite, must be further guided by a scientific system of tests made during the smelting operation. Tests can be made by periodically ladling a sample from the molten mass in the furnace for chemical analysis. Illustration Fig. 1 illustrates this operation as a result of this continuous checking, the chemical analysis of every ingot will be identical. Newly discovered methods of furnacing are already available to further accurately control the physical properties of such an abrasive grain.

No factor contributes more to pol-

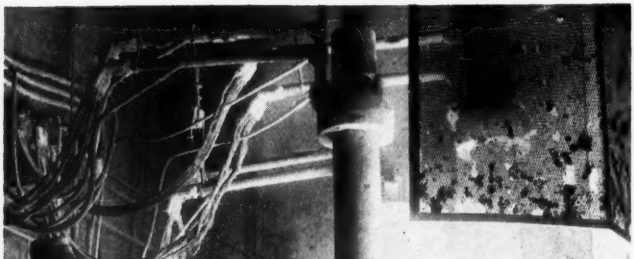


Fig. 1 — A familiar scene in the abrasive manufacturing plant. The workman shown here is ladling the sample of a molten mass of prepared Bauxite for chemical analysis.

ishing grain performance than proper grain shape. With this factor in mind in developing new features in an abrasive grain, the abrasive should be subjected to a scientific system of crushers adapted to this purpose. Figure 2 shows the first crushing operation. The type of crushing employed results in a polyhedral grain shape with grains presenting many cutting edges.

To assure proper retention of an abrasive grain on the polishing wheel under the stress of rough polishing, close attention is required to the capillarity, temper, and surface treatment of the abrasive grain. In reaching the intended goal in the development of a non-glazing abrasive grain, the scientific roasting of the abrasive grain is an important factor to produce these three features. The polishing grains require an oxidizing roast at high controlled temperatures. Figure 3 illustrates rather clearly equipment required for the roasting operation. During this heat treatment, a chemical reaction will be effected which tempers the grains, produces maximum capillarity and actually etches the surface of the abrasive grains. High capillarity is one property of abrasive grains that determines the life of the polishing wheel. High capillarity permits the abrasive grains to soak up glue during the setting up operation and allows the glue to more firmly hold the abrasive grains to the wheel. The actual etching of the grain surface will also further this action by giving the glue a roughened surface to adhere to.

The further successful development of this type of abrasive grain requires a definitely predetermined grain shape with the grains graded to a definite uniformity of sizes. Undersize grains, in each size grading, which would fail to do their share of the work and so cut down production must be carefully eliminated.

A final assurance that the intended new properties have been built into the abrasive grains can be had by a careful laboratory check into the following properties:

Grain Size
Capillarity
Grain Shape
Surface Etching
Bulk Specific Gravity
Temper
Packing Quality
Chemical Composition

The effect of a higher aluminum

oxide content of an abrasive grain will be to make a sharper cutting abrasive grain and provide a faster cutting medium. This will result in greater ease of polishing. The rapid cut will also tend to eliminate mechanical heat generated by duller grains and harder pressure of work against the wheel. This will ensure cooler cutting wheels and less chance of burning or discoloring the work.

Abrasive grains more friable than the average abrasive polishing grains, after doing their proportionate share of the work, will break on a line of cleavage and present new cutting faces. At the same time metal particles picked up by the wheel are freed and in this manner "loading" or glazing is eliminated.

EPT Lionite in grit sizes No. 20 to No. 90 inclusive was developed during the past year as a step toward meeting the demand for a cool, fast-cutting, non-glazing abrasive grain for rough polishing.

The following table is offered as a general guide for the selection of grain sizes for rough polishing:

Aluminum Sheets No. 80
Aluminum Sand Cast Nos. 36-46-60-80
Automobile Parts Nos. 20-24-36-46-54-60-70-80-90
Axes Nos. 24-36-46-54-70-80-90
Balls — Steel Nos. 60-70-80-90
Band Saw Steel Nos. 60-70-80
Brass—Sand Cast Nos. 60-70-80
Bicycles Nos. 60-80
Builders' Hardware Nos. 46-54-60-70-80-90
Butchers' Tools Nos. 46-60-70-80
Carpenters' Tools Nos. 36-46-54-60-70-80
Cutlery Nos. 20-24-36-46-54-60-70-80-90
Dental Goods Nos. 80-90
Electrical Appliances Nos. 46-60-70-80-90
Fire Arms Nos. 60-90
Forgings Nos. 36-46-60-80
Garden Tools Nos. 36-46-54-60-80
Gray Iron—pickled No. 80
Gray Iron—not pickled No. 70
Hammer Heads Nos. 60-90
Harrows Nos. 30-36
Hinges No. 80
Hoes Nos. 36-46-54-60
Knives Nos. 30-54-70
Locomotive Parts Nos. 24-30-36-46-54-60 70-90
Machine Parts Nos. 24-30-36-46-54-60-80
Masons' Tools Nos. 60-80
Mechanics' Tools Nos. 36-46-54-60-80-90
Miners' Tools Nos. 46-60-70-80
Monel Metal—cast No. 80
Motor Parts Nos. 36-46-60
Piano Parts Nos. 80-90
Picks Nos. 46-60-80
Pliers Nos. 60-80
Plows Nos. 20-24-30-36-46-80
Plumbers' Supplies Nos. 60-80-90
Radiators Nos. 46-60
Refrigerators Nos. 60-70-80-90
Sad Irons Nos. 60-80-90
Safes Nos. 36-60-80
Saws Nos. 30-36-60

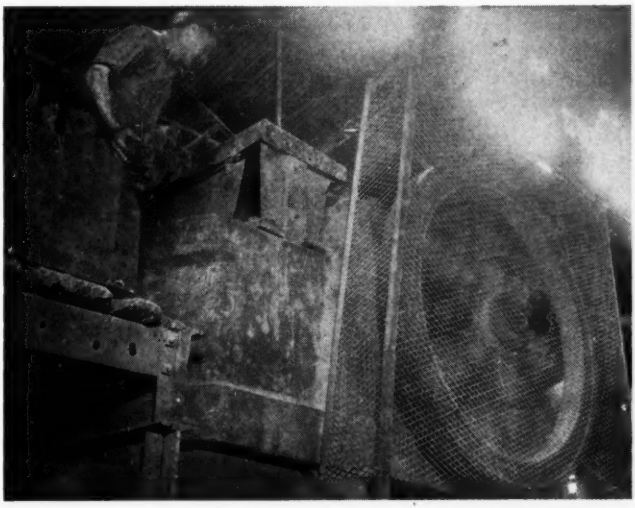


Fig. 2—After the molten mass of specially prepared Bauxite cools, it is broken into large lumps prior to crushing. This illustration shows a workman feeding a crushing machine with the large lumps.

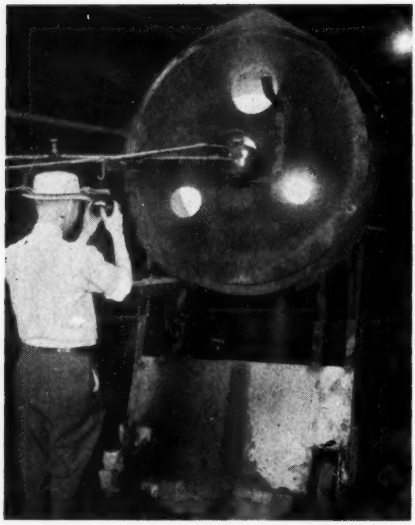


Fig. 3—After the large lumps have been reduced to small abrasive grains, the grains are roasted in an electric furnace of the type shown here. The temperature of the abrasive grains in the furnace is being checked by the workman shown in the illustration.

Scales Nos. 24-60-90
Sewing Machines Nos. 60-80-90
Shears Nos. 54-80-90
Shovels Nos. 36-46-70
Silverware Nos. 36-46-60-80
Skates Nos. 60-80
Stainless Steel Nos. 60-80-90
Stove Parts Nos. 46-54-60-70-80-90
Typewriter Parts Nos. 36-60
Vacuum Cleaners Nos. 70-80-90
Valves No. 80
Wrenches Nos. 36-46-90

"Color in Display." The importance of color in display and how it can detract or enhance the merchandise displayed is covered in "Color in Display" by Quentin Crisp and is now being published by Chemical Publishing Co. of N. Y. Inc., 148 Lafayette St., New York, N. Y. The contents of this book include: window display, theory in color, simultaneous contrast, extremes, maximum contrast, distance, visibility, emotions, color lighting, practice of color, associational values, colors for fashion displays, drapery, men's and children's clothing displays, color considerations in other trades, application in color, basic colors, mixing colors, shapes and symbols, and color and lettering symbols.

Copies of "Color in Display" are available at two dollars each.

"Neville Resins." This is the title of a 64-page booklet in which distinctly enw types of resins which have been produced to meet industrial demands for thermoplastics for modern applications by The Neville Company, Neville Island, Pittsburgh, Pa., are described. The 64 pages present in detail the properties, specifications and uses of the various types and classes of thermoplastic resins that are offered for general industrial use. Copy of this booklet will be sent free upon request.

"Design of Industrial Exhaust Systems." The Industrial Press, 148 Lafayette St., N. Y., is now issuing a cloth-bound, 220-page book by John L. Alden entitled "Design of Industrial Exhaust Systems."

The purpose of this book is to tell the engineer how to design and build or how to buy an exhaust system that will adequately and economically perform the functions prescribed by the industrial hygiene expert or by law. Although exhaust ventilation has been practiced for more than 70 years and has been recognized by statute for more than 40 years, the literature is astonishingly scanty.

There seem to have been two major contributing factors: First, the field has been relatively small and inconspicuous and has not attracted the attention of colleges and other independent investigators. The second, and perhaps, predominant factor has been that many of those within the industry have treated their accumulated data as precious trade secrets to be divulged neither to competitors nor to customers. The author aims to dispel most of the mystery surrounding exhaust work and to express many of the trade secrets in straightforward engineering terms.

This book covers the following subjects: Flow of fluids; hood forms; air flow through hoods; pipe resistance; piping design; dust separators; low pressure conveyors; centrifugal exhaust fans; structural details and system planning; field measurements and their interpretation.

The price of "Design of Industrial Exhaust Systems" is three dollars per copy.

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Urea Formaldehyde Finishes for Metal Products

By C. W. HAYNES
Director of Research, C. W. Haynes Laboratories, Inc.

THE interest created by the use of urea formaldehyde finishes is increasing by leaps and bounds because they offer to the fabricator of metal goods, a finish that was heretofore impossible on a commercial scale at a reasonable cost. These coatings are truly remarkable in their resistance to abrasion, since they provide hard, tough and scratch-proof surfaces. Burning alcohol and cigarettes, perspiration, grease and fruit acids and the proverbial purchasing agent's thumbnail have little or no effect upon them. The white finishes produced are similar to porcelain in appearance, hardness and the ability to stay white. The urea formaldehyde type of finish does not chip easily, nor is it brittle. Clear water white finishes have been produced which have all the above characteristics and stay water white for an unusually long length of time.

Many alert manufacturers of metal kitchen and radio cabinets, electric refrigerators, ironers, washing machines and stoves have been quick to avail themselves of this gleaming white, lustrous finish. One coat (either direct to the metal or over a filler that is baked with the top coat in one baking operation) produces a finish that resists fruit acids, alkalies and chipping. It may be repaired with ease should chipping or damage occur either in manufacture or in shipping. Chipping in transit is practically unknown to users of urea formaldehyde finishes because of the flexibility of this type of finish. Until one has seen for himself the porcelain-like surface hardness and appearance, combined with unusual flexibility, it is hard to conceive of two such ordinarily dissimilar properties in one finish. White finishes have also been developed that have unusual resistance to yellowing, even where somewhat elevated temperatures are present, together with unusual re-

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sistance to soap and alkali solutions, as well as perspiration.

Any manufacturer of metal goods desirous of improving either the appearance or wearing qualities of his product should investigate its possibilities, for it is extremely well adapted for use on flashlights, compacts, metal clocks, typewriters, office and business machine equipment, cash registers, and the like. On all of the above items the resistance to perspiration, abrasion and chipping is desirable if not imperative. These features, coupled with a lustrous, deep, porcelain-like finish, form a combination of eye appeal and wear that is unusual.

Urea formaldehyde coatings are also produced in a clear water white finish that stays water white and should be of interest to manufacturers of brass hardware, polished brass goods of all descriptions, ash trays, lamps and novelties where it is desired to enhance, protect and show the bare metal to the best advantage. Both clear and colored finishes are now on the market that have as good adhesion to brass, zinc die castings, and so on, as to steel. This feature, together with the development of a new type urea formaldehyde finish that bakes at temperatures as low as 150 degs. F. for one-half hour, makes its application in the clear to polished brass of extreme interest, because it is no longer necessary to bake at a high temperature or for a long period of time to obtain a thorough bake or cure, which might cause discoloration of the metal.

The benefit of a short bake at a low temperature is also of interest to those manufacturers who have oven equipment that is heated by steam because the newest types of urea formaldehyde finish require only one-half to one hour at 150 degs. F. for baking. This finish is produced in colors as well as in the water white clear and thus places at the disposal of any manufacturer who has steam available, the advantages of a urea formaldehyde finish.

The widespread acceptance of the urea formaldehyde type finishes is sufficient proof of their value in the field of metal finishing.

"Valdura No-Rust Primer." This is the title of a 6-page illustrated folder which is now being issued by American Asphalt Paint Company, 43 E. Ohio St., Chicago, Ill. Valdura No-Rust Primer is said to form an air-tight film over rusted metal and thus seal out all oxygen and stop further rusting. This primer material is recommended for application on surfaces such as rusted tin, galvanized iron and rust-pitted iron coatings and steel plate.

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RUMFORD CHEMICAL WORKS

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Heat Resisting Alloys in the Vitreous Enameling Industry

By G. C. STAUFFER
Assistant Manager, Technical Department, Driver-Harris Company

THE heat-resisting alloys used in vitreous enameling equipment comprise a rather large group characterized more by their general properties than by their compositions. The field has grown so large that the selection of the proper alloy by a user who is not a metallurgist has become increasingly difficult. While a comprehensive treatment of the subject is beyond the scope of a single article, it is possible to summarize the outstanding advantages and limitations of this group of alloys for such use.

The outstanding characteristics of the heat-resisting alloys are their freedom from loose scale formation when heated, and their resistance to corrosion. Coupled with these characteristics is the retention of strength at elevated temperatures. Both of these categories and particularly the latter, require some discussion if the best alloy for the purpose is to be chosen.

When chromium in appreciable amounts is alloyed with iron or nickel or both, it imparts to the alloy a remarkable resistance to the effects of oxidizing atmospheres. A dense but superficial layer of oxide is formed almost at once on the surface when it is heated. So long as this film is intact the oxidizing gases cannot penetrate it to cause successive oxidation. Most of the chromium alloys will show little deterioration over long periods of continuous heating. However, if the metal is alternately heated and cooled, it will be found that the alloys with higher nickel content are far superior in their ability to withstand the ravaging action of the hot oxidizing gases. This is probably due to the fact that the metal and

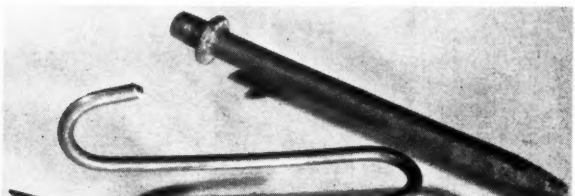

Fig. 1—Illustration showing two cast pins and a wrought support hook that have been made of nichrome — an alloy compounded to withstand the punishment of an enameling furnace.

oxide have more nearly the same coefficient of expansion, thus lessening the tendency of the oxide to break away from the metal. In general, alloys having a combined nickel and chromium content of at least 40 per cent are required for best results. The best alloy from this angle is 80 per cent nickel and 20 per cent chromium, which is also used for heating elements.

Other common analyses are:

Nickel	Chromium	Iron
60	15	Balance
35	15	Balance

It is obvious from what has been said that the oxide should not be mechanically abraded by rough handling. In addition, it is not always realized that some of the ingredients used in enamel are the same as those used for fluxes in welding these alloys. These are Borax and some of the flurides. These materials in the molten condition dissolve the oxides quite readily. This may be an advantage or disadvantage to the user. In the case of support pins, some users prefer a pin which keeps itself sharp by the continual fluxing away of the oxidizing point. In this case, it is preferable to use the 35 per cent nickel - 15 per cent chromium alloy since this forms a somewhat thicker oxide than the 60-15 or 80-20 alloys and the subsequent fluxing keeps the point sharp.

On the other hand, for hooks it is often noticed that the section at the bend is reduced due to the fluxing action of the dripping enamel at this point. The attack is lessened by the use of the higher nickel alloys.

In any case, the use of nickel alloys is advisable because the lack of loose scale prevents spotting of the work by oxide popping off during either the heating or cooling cycle.

The strength of the alloy is important since with a stronger alloy the section can be made smaller and the ratio of weight of alloy to weight of work, reduced. This is a complex property where elevated temperatures are concerned. Ultimate tensile strength at temperature is meaningless as far as design goes, since the metal will continue to elongate at much lighter loads. A measure of strength has been developed in the "creep strength" of the material. This is the load required to produce .1 per cent elongation in 1,000 hours at a given temperature. It has been found that the tests must be run for a very long time to be reliable. The difficulties of this type of test are obvious, and while a great deal of work has been done, there is much still remaining to be done.

Probably most of the trouble with bent hooks and sagging comes from the employment of hooks designed for light work being used on progressively heavier pieces as expediency re-

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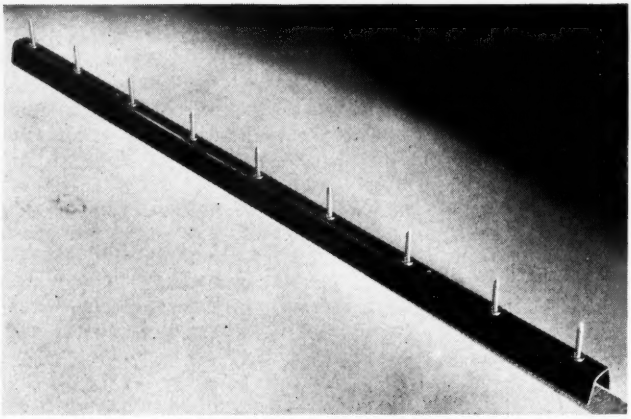

Fig. 2—A channel pin bar as rolled from nichrome sheet and wire.

quires. Even then, it is not usually a question of overloading the shank of the hook, but putting a bending strain on the side of the hook which is greater than the material will support when it is hot. Hooks should be formed to give loading as near axial as possible. In the case of "coat hanger" supports, a strut or trussed design can often be made to weigh less than a solid piece and yet give greater support. A conservative guide for the selection of rod sizes is given below.

Weight Lbs.	Rod Diameter	Weight Lbs.	Rod Diameter
10	.128 in.	110	3/8 in.
20	.162 in.	120	7/16 in.
30	.204 in.	130	7/16 in.
40	.229 in.	140	7/16 in.
50	.250 in.	150	7/16 in.
60	.289 in.	160	7/16 in.
70	5/16 in.	170	7/16 in.
80	5/16 in.	180	1/2 in.
90	3/8 in.	190	1/2 in.
100	3/8 in.	200	1/2 in.

This data is applicable to the 35/15 and stronger alloys.

These should not elongate with these loads at temperatures up to 1,800 deg. F. Cases of fracture of the supports in which there was no noticeable elongation have come to the writer's attention from time to time. This is caused by intercrystalline attack on the metal by the gases and possibly the enamel. This corrosion is analogous to that of 18/8 and other stainless steels under certain conditions of fabrication and use.

All of these alloys contain carbon in addition to the chromium, which is such an important part of the alloy. The carbon and chromium combine under certain conditions of heating to form the chemical compound, chromium carbide, at the grain boundaries of the metal. The result of this is that the alloy near the boundaries contains less chromium than the rest of the metal. This reduces its resistance to attack at this point and failure may occur very rapidly. Heating to temperatures between 1,100 deg. F. and 1,600 deg. F. cause the most carbide precipitation. Since this temperature range is one of common use, alloys as low in carbon as possible should be used in order that the carbide shall be of minimum amount. It is also possible to re-dissolve the carbide by heating to 2,000 deg. F. and quenching. This, it is advisable to do periodically if facilities are available.

An hour's heating in an open furnace, followed by a quench in water is satisfactory.

Since internal strain as well as

strain from loading with ware contributes to cracking, a thorough anneal of sharply bent pieces is very good practice. Most of the smaller sizes can be formed cold without difficulty. Heavier sizes may be formed hot. However, due to the detrimental effect of sulphur gases on the metal, the blacksmith forge should not be used for heating. Local heating with the welding torch is preferable. It should also be remembered that these alloys are somewhat hot short at temperatures below 1,400 deg. F. The rod must be a bright red when it is bent to avoid cracking. In welding, either gas or electric methods may be used. Any welder capable of handling stainless alloys can do a good job on the higher nickel chromium alloys.

Hilo Technical Bulletin on Metal Treatment. Those engaged in metal-finishing operations will be interested in this 6-page bulletin which deals primarily with cyanide spotting which is now being issued by Hilo Varnish Corporation, 42-60 Stewart Ave., Brooklyn, New York.

Whenever plated specimens show any type of spotting on the surface, it is generally termed "cyanide spotting." This term covers a multitude of problems and is discussed from many angles in "Hilo Technical Bulletin on Metal Treatment." Cyanide spotting is due to a number of causes and several of these are found under the headings as follows:

1. Lacquering the plated objects in a dirty atmosphere.
2. Porous castings which absorb the plating solution; this attacks the castings in the fissures and produces salts which swell and come to the surface where they can be seen.
3. Improper rinsing of the electro deposits.
4. Improper cleaning of electro deposits.
5. Careless usage of addition and brightening agents.
6. Plating solutions which are out of balance.

A copy of "Hilo Technical Bulletin on Metal Treatment" which deals with cyanide spotting will be sent free upon request.

United States Electric Tools Catalog No. 52. In this 72-page catalog The United States Electrical Tool Co., 2471 W. Sixth St., Cincinnati, Ohio, presents the complete line of electric tools made by this firm. The line includes bench and floor buffers, buffer accessories and buffing wheels, electric drills, flexible shaft machines, tool post and angle plate grinders intended for use with various types of machine tools, swing frame grinders, tool grinders, bench and floor polishers, sanders, portable electric saws, tappers, valve seat grinders, and a wide variety of other tools of both portable and stationary types, together with the wheels, brushes, and other accessories to these tools.

All of the various types and kinds of tools are illustrated and complete descriptions and tables of specifications are included. Copy free upon request.

Monel Parts. An explanation of how Monel gaskets, pump parts and valve parts can add new life to old equipment is contained in a circular published by The International Nickel Company, Inc., 67 Wall St., New York, N. Y. A number of service records describing typical examples in which Monel parts have been employed are included. Copy free upon request.

SHEET STEEL COMES CLEAN AT 250 F.P.M.
SHEET STEEL is cleaned at 250 feet per minute with a five second immersion in a Metso bath—just one example of the fast, thorough cleaning that Metso insures. Balanced properties of alkali and silica maintain efficiency so that Metso baths last longer.
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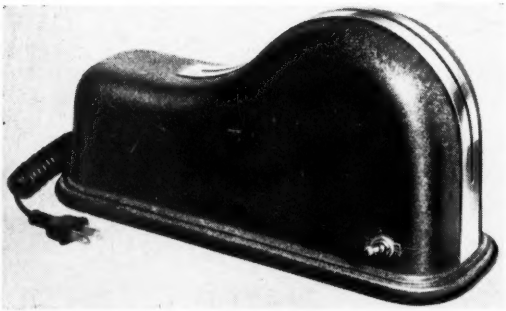
Chicago Sales Office: 205 W. Wacker Drive
METSO CLEANERS

FINISHES *that aid in Appearance & Utility*

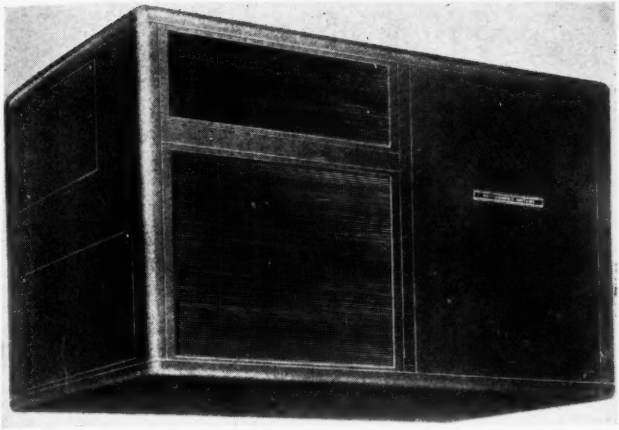
(Right) — Incorporation of architectural themes in door signals to harmonize with interior motifs is a feature of a modern door chime such as the one shown here. Smart as smart can be in oyster white finish framing a blue mirror on which is fastened a chromium plated star, this chime is consecutive enough for any formal interior.

(Photo Courtesy Designers for Industry)



(Left)—This grinder solves the knife sharpening problem and is designed into a beautiful machine that has eye appeal as well as performance. The housing is of aluminum alloy casting with polished trim and body finished in black lacquer.

(Photo Courtesy Duwell Manufacturing Co.)



(Photo Courtesy Westinghouse Electric & Manufacturing Company)

(Above)—A self-contained air conditioning unit for commercial establishments enclosed in an all-steel welded cabinet. The cabinet is finished in an attractive brown enamel finish.

(Below)—Here are two junction signs fabricated from a Paintgrip sheet, as they appear before and after painting. The special phosphate coating of this new galvanized sheet has the appearance of slate instead of the conventional bright spangles.

(Photo Courtesy The American Rolling Mill Co.)

NEWS of the Industry

Gehnrich & Gehnrich Appoint Representatives

According to a recent announcement, two representatives have been appointed by Gehnrich & Gehnrich, Inc., 32 57th St., Woodside, N. Y., to cover the company's line of industrial ovens, dryers, air heaters, and so on.

Mr. Gustav Schwab at the Schwab Industrial Laboratories, Elizabeth, N. J., will act as representative in Northern New Jersey and all of the State of New York with the exception of Metropolitan New York City. Mr. W. W. Young of Waterbury, Conn., will act as representative in Connecticut, Massachusetts and Rhode Island.

Norton Company Announces Changes in Organization

According to a recent announcement, Norton Company, Worcester, Mass., has announced changes in the headquarter's sales organization of its Abrasive Division.

Mr. G. A. Park, formerly assistant sales manager, has been appointed eastern sales manager in charge of the territory east of and including the Pittsburgh district.

Mr. R. M. Johnson, formerly sales engineer, has been appointed western sales manager, and will have charge of the Cleveland, Detroit and Chicago warehouses and other western territories.

Mr. A. G. Green of the research laboratories will take over the position of sales engineer formerly held by Mr. Johnson.

Mr. W. R. Moore, as the newly-appointed sales manager, will direct the activities of these three men. Mr. Moore will report to Mr. H. K. Clark, vice president.

Mr. W. T. Montague has been appointed assistant vice president. He will continue to supervise the staff activities of the sales department, including sales research, publicity, sales training and traffic, reporting directly to Vice President Clark.

Institute of Electrochemistry and Metallurgy

The Institute of Electrochemistry and Metallurgy, 59-61 East 4th St., New York City, has announced the opening of registration for the second semester classes in Electroplating II, Metallurgy II, and Research II beginning February 4th. The classes will be in charge of Dr. C. B. F. Young, who is assisted by Mr. Walter Klinsevich and Mr. Louis Sherman.

During the term beginning February 8th in the course of Electroplating II, the student is taught to apply the fundamentals of electrochemistry to electroplating so that better deposits can be obtained. One hour of each evening is devoted to a lecture by the instructor in which the latest theories of electrochemistry are applied to electroplating. The remaining three-hour period is devoted to a laboratory period where the student applies the above theories. Copper, nickel, zinc, cadmium, chromium, silver, and brass are deposited. While

Students at work in the laboratory of The Institute of Electrochemistry and Metallurgy.

plating the above, the factors governing the character of the deposit, such as current, density, pH, temperature, addition agent, and so on are noted. Other experiments deal with throwing power, single electrode potential, resistance of solution, thickness of deposits, corrosion tests, anodizing and coloring of aluminum, and so on.

After completing the above, the student prepares standard solutions and analyses for the important constituents in the bath of the above mentioned metals.

In the course of Metallurgy II, one hour each week is devoted to a lecture on physical metallurgy. This course is designed to give the student a technique in polishing, etching, and examining under the microscope various ferrous and non-ferrous metals and alloys.

Research II is a course designed to give the electrochemist a chance to investigate certain problems arising in his work. One-half hour of each week is devoted to a conference with the instructor, the remaining time being spent in the laboratory where the student solves the various problems arising in such an investigation.

Newark Branch of A. E. S. Makes Plans for 1939 Convention

The Newark Branch of the American Electro-Platers' Society was awarded the Annual Convention for 1939, and are now laying plans and have all committees working to make this convention the largest and best convention ever held by the American Electro-Platers' Society. The convention for 1939 will be international in scope, the first ever held by any branch and will be held at Asbury Park, N. J., June 19th, 20th, 21st and 22nd.

The location of the International Convention at Asbury Park will be convenient for those who also wish to attend the New York World's Fair, since New York City is less than an hour from Asbury Park.

The educational sessions of the International Convention will consist of discussions and papers pertaining to electroplating contributed by some of the noted chemists and platers of the world. There will be exhibits of manufacturers

If you have a finishing problem of unusual difficulty.

If you are interested in checking your present schedule for economy.

If you are merely curious as to what we have to offer.

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SPECIALTIES

of plating and polishing, burnishing, electrical equipment, and manufacturers of supplies and chemicals. There will also be a large exhibit by manufacturers and platers of plated articles of all descriptions. The convention committee has arranged for visits of inspection to some of the large plants located in New Jersey.

Anyone who desires further information regarding the A. E. S. International Convention at Asbury Park is requested to write to Mr. M. C. Hoy, 352 Mulberry St., Newark, New Jersey.

Baltimore-Washington Branch of A.E.S. Hold Educational Session

According to a recent announcement, the Baltimore-Washington Branch of the American Electro-Platers' Society will hold an educational session and banquet at Lord Calvert Inn, Washington Blvd., Washington, D. C., Saturday, February 4th. The educational session will start promptly at 2 p. m. and the banquet at 7 p. m. Tickets are two dollars.

A. C. & C. Corporation Appoint Distributor

According to a recent announcement, the American Cyanamid & Chemical Corporation, New York City, has announced the appointment of The Lea Manufacturing Company, Waterbury, Conn., as a distributor in the sale of industrial cyanides for use in the electroplating industry.

Allis-Chalmers Establishes Branch Office and Warehouse in Newark

A branch office and warehouse of the Allis-Chalmers Manufacturing Company, Milwaukee, Wis., has been established in the Industrial Office Bldg., 1060 Broad St., Newark, N. J. This office will be a branch of and under the jurisdiction of the New York district office of the company and is expected to provide additional service in the Newark area for Allis-Chalmers motors, pumps, power transmission units and other equipment in the company's line.

Mr. C. A. Pihl has been appointed manager of the Newark branch office.

Cutler-Hammer, Inc. Announces Promotions

The promotions of Mr. E. W. Seeger to chief engineer and Mr. P. B. Harwood to assistant chief engineer have been announced by Cutler-Hammer, Inc., Milwaukee, Wisconsin.

Mr. Seeger became associated with Cutler-Hammer in 1913, shortly after receiving a degree from Ohio State University. During the ensuing fifteen years, he had considerable experience in shop and engineering departments, becoming assistant chief engineer in 1928, a position which he has held to the present time.

Mr. P. B. Harwood

He is a member of the Engineers' Society of Milwaukee, having served as director from 1934 to 1936; is a Fellow in the American Institute of Electrical Engineers and chairman of the Milwaukee Section in 1929; is a member of the Codes and Standards Committee of the National Electrical Manufacturers' Association; affiliated with F. & A. M. and Eta Kappa Nu fraternal societies, and a

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member of the University Club and the Tripoli Country Club. He is author of several articles on the control of electric motors and holds a large number of patents on electric motor control inventions.

After graduating from Carnegie Institute of Technology in 1917, Mr. Harwood was employed by Cutler-Hammer,

Mr. E. W. Seeger

entering the company's training course that year. He was shortly transferred to the engineering department where he spent several years as a designing engineer. In 1923 he was made supervisor of the Steel Mill Division, and in 1928 was promoted to general supervisor of the engineering department. From 1934 to 1936 he was assigned to the development of propulsion control for submarines.

Mr. Harwood is a member of the A. I. E. E. and an associate member of the A. I. S. E. and the U. S. Naval Institute. He is a member of Theta Xi and Tau Beta Pi. Author of numerous articles, he also wrote a book, "Control of Electric Motors," published in 1936. Mr. Harwood is responsible for a very impressive list of inventions which have been patented.

Joint Meeting of New York and Newark Branches of American Electro-Platers' Society

Saturday afternoon and evening, Febcational and social session of the New ruary 18th, is the date of the joint edu-York and Newark Branches of the American Electro-Platers' Society to be held at the Hotel Pennsylvania, 7th Ave. and 33rd St., New York City. The educational session will take place at 2:30 p. m. and a banquet will follow at 7 p. m. The price per person is four dollars.

The speakers at the educational session are as follows: Dr. C. B. F. Young, Librarian New York Branch, Chairman; Dr. C. L. Mantell, Electro - Chemical Division, Pratt Institute of Brooklyn, N. Y.; Mr. Frederick Fulforth of the Philadelphia Branch; Mr. Joseph Haas, Electro-Chemical Engineer and Past Associate Editor of the Brass World; and Mr. Joseph Downs, Electro-Plating Supervisor, Remington-Rand Company.

For reservations, please write to Mr. F. J. Mac Stoker, Secretary, 25 Princeton St., Garden City, New York.

Porter-Cable Appoints Sales Promotion Manager

Harvey L. Ramsay has been appointed sales promotion manager for Porter-Cable Machine Company, Syracuse, N. Y., manufacturers of industrial sanding machines, floor sanders, and electric hand sanders.

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Cooplac No. 82 gives a lasting, transparent film on metal, wood or paper. Write for full information.

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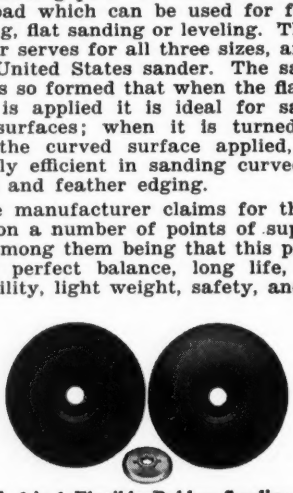
NEW *Plant equipment and* MATERIALS

"U. S." Three-In-One Flexible Rubber Sanding Pad

Announcement is made by The United States Electrical Tool Co., Cincinnati, Ohio, of a new three-in-one flexible rubber sanding pad. This is a molded rubber pad which can be used for feather edging, flat sanding or leveling. The one holder serves for all three sizes, and fits any United States sander. The sanding pad is so formed that when the flat surface is applied it is ideal for sanding flat surfaces; when it is turned over and the curved surface applied, it is equally efficient in sanding curved surfaces and feather edging.

The manufacturer claims for this invention a number of points of superiority, among them being that this pad affords perfect balance, long life, great flexibility, light weight, safety, and that



U. S. 3-in-1 Flexible Rubber Sanding Pad

it is non-breakable. The pad holder nut fits 5, 7 and 9-in. pads. The pad is of solid rubber without metal base which makes it very flexible and enables the user to get the utmost possible life out of the appliance. There is no danger of abrasives injuring the operator, friction is reduced, time is saved because of the flexilibity of the pad, and the sander can get into places which formerly may have had to be finished by hand because of their inaccessibility with a tool.

Miccro Supreme Better Seal Compound

Michigan Chrome Company, 6342 E. Jefferson Ave., Detroit, Mich., has developed and placed on the market a liquid compound to be used as a permanent seal for joints and seams on equipment where gases, oil, steam, and so on are used. The compound is to be known as Miccro Supreme Better Seal Compound.

Among its many applications are pipe threads, face joints, tank seams, compressors, gaskets and valves, the coating of metal—in fact, wherever leakage is likely to occur, this compound is said to offer protection against even the smallest opening which might be caused by vibration, expansion, contraction or chemical damage resulting from the contact of certain gases or solvents on metal surfaces.

Miccro Supreme Better Seal Compound is completely insoluble in gasoline, oil, steam, gases such as Freon, methyl chloride, ammonia and sulphur dioxide, and in the majority of commercial solvents (alcohol excepted). While the compound possesses unusual adhesive quali-

ties, it is said to be extremely elastic and will withstand the most severe vibration without cracking. Once applied it becomes a permanent seal, eliminating the possibility of future leakage. It can be applied instantly with either a brush or the fingertips. It sets quickly, permitting the equipment to be put back into operation without delay.

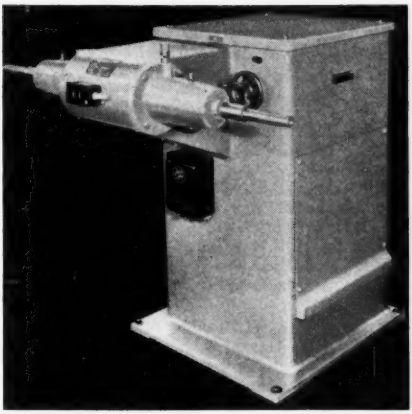
Glidden Anavitro Enamel

A synthetic type of enamel which is said to be formulated to meet production demands in the finishing department is now being manufactured and marketed by The Glidden Company, Berea Rd. at Madison Ave., Cleveland, Ohio. Anavitro Enamels are said to be very resistant to gasoline, lubricating oil, pickling vinegar, and materials of a similar nature. This type of enamel is said to be particularly well adapted for the finishing of machinery of all kinds, metal cabinets, and miscellaneous metal specialties.

One coating of Glidden Anavitro Enamel will cover solidly over bare metal. The finish dries dust-free in 15 to 20 minutes, dries to handle in two hours and thoroughly dries in six to eight hours. When thoroughly dry, Glidden Anavitro Enamels are said to approximate baked finish toughness. When specifications demand, Anavitro Enamels can be baked 20 to 30 minutes at 180 to 200 degrees F.

Crown Variable Speed Lathe

A variable and instant speed is said to be the new feature incorporated into the standard long-overhang polishing lathe which was recently placed on the market by Crown Rheostat & Supply Co., 1908 W. Maypole Ave., Chicago, Ill. Scratch brushing, buffing, and polishing can be performed if desired, since



Crown Variable Speed Lathe

the change from one speed to another requires but a fraction of a minute. By merely turning the hand wheel, variable speeds ranging from 870 to 3,050 r.p.m. are obtainable.

The Crown Variable Speed Lathe is equipped with a 14-inch overhang, thus allowing greater freedom in the handling of large and bulky workpieces. Another feature is said to be its base of welded steel construction which permits greater control of weight distribution and balance. The spindle is readily accessible and servicing is said to be a simple matter. The standard unit operates from a V-belt drive belt at 5 horse power.

Universal Air Filter

Wherever dry, pure air, free of moisture, oil and other impurities is required for process work, the oil, mois-

DID YOU KNOW THAT—

A gun metal finish of unusual durability can be applied to a wide variety of tools? See page 13.

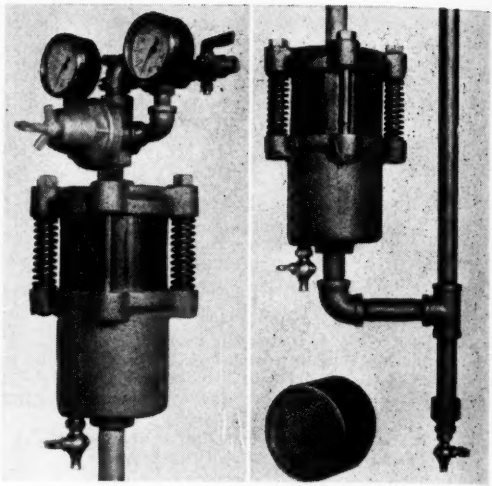
If a surface of a stamping is so irregular as to require a cutting down operation, it is recommended to change the grade of the raw material and use a smooth finished surface material that will not require such an operation after forming? See page 20.

PRODUCTS FINISHING is an ideal, economical medium for advertising equipment and supplies used in the cleaning, plating, polishing and finishing of metal products? See pages 32-33.

ture, and impurities can be filtered out of the air by the Universal Air Filter now being marketed by Universal Filter Sales Co., 4221 Forest Park Blvd., St. Louis, Missouri.

The design of the filter is based upon the use of a manufactured stone containing minute pores through which the compressed air is filtered. The stone is highly porous, the 6-in. stone in a 1-in. filter having more than one million pores through which the air must pass.

Separation of a large percentage of oil and water is accomplished in the bottom chamber of the filter prior to passage of the air through the fine filter stone. This is done through centrifugal motion. The air flow is vertically upward and the velocity of the air is such that the whirl motion in the bottom chamber causes the larger particles of oil, water and other impurities to be thrown out against the inner rim through which they collect by gravity at the bottom of the chamber. The life of the filter stone is indefinite and, with proper care, should last the life of the filter housing itself. The filter is cast of high grade semi-steel and the rings surrounding the filter stones are of steel.



Universal Air Filter

National Metal Abrasive

Shot and grit for blast or centrifugal cleaning has been placed on the market by National Metal Abrasive Co., 3561 Norton Rd., Cleveland, Ohio. This material is said to be an improved abrasive due to the fact that new proportions of standard elements including silicon, manganese, sulphur, nickel and copper are used. These elements are mixed in molten form for the production of this abrasive.

Extensive tests have shown that application of the National Metal Abrasive in cleaning castings results in surfaces that are smooth and at the same time rough or porous to provide good anchorage for a dipped or sprayed coat of finishing material.

Willson Protecto-Shield

Willson Products, Inc., 271 Thorn St., Reading, Pa., has placed on the market a new shield to be known as "Protecto-Shield" for guarding the faces of work-

RUST-I-CIDE "50"
Cleans, etches, and prepares metal for a perfect finishing job.
It can help your product.
RUSTICIDE PRODUCTS CO.
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For a real good polishing job use
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TURKISH — NAXOS — AMERICAN
KEYSTONE EMERY MILLS *Write for Sample* 4316 Paul St., Phila., Pa.

ers in light grinding and polishing operations and other operations where protection is desirable.

The Willson Protecto-Shield permits clear vision in all directions. It is made

Willson Protecto-Shield

of thick transparent cellulose acetate, is well ventilated and large enough to fit comfortably over correction spectacles. The shield extends well back along the sides of the face and can easily be thrown back when not in use. A special Willson knitted sweat pad is said to provide unusual comfort. The Protecto-Shield is light in weight.

The adjustable molded rubber headband and all other parts are easily replaceable. The shield is available in clear, amber or green transparent cellulose.

Trane Air Conditioning Equipment

A gas fired air conditioning unit which is equipped to deliver heated or cooled air has been placed on the market by Trane Company, Third and Fourth Sts., La Crosse, Wis. Two models of this type of air conditioning equipment are available, one for floor mounting and the other for suspension overhead.

The various parts of the Trane Air Conditioning Unit are arranged to draw air in through removable filter elements to enter a blower type fan through a heat exchanger. The air then passes through a humidifying element and then passes through a side housing which is arranged for duct connection. At the base of the heat exchanger is a gas burner assembly and located at the left of the assembly are the burner controls.

The equipment is available with complete provision for automatic control and for automatic shut down in the event of any failure in the gas supply or free air passage. Operation can be thermostat-actuated to maintain desired temperatures within the capacity of the unit.

Kingbee Spraymaster for Fine Ground Enamels

A special sized tip nozzle and metal plunger which can be attached to a standard type Kingbee Spraymaster which is said to aid in applying finely ground enamel has been placed on the market by The O. Hommel Co., 209 Fourth Ave., Pittsburgh, Pa. The tip and nozzle is said to provide a perfect spray of finely ground enamel at high, efficient speeds.

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MAGIC TACK RAGS remove specks, lint and sand particles--- bring out that deep, smooth luster, produce a faultless surface for white or colored finish. Why use "home made" tack rags when you can buy MAGIC TACK RAGS at trifling cost! They are tackier, do not dry--- are dust-proof and spontaneous combustion proof. Packed in dozen and gross lots or more. Made only by the

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If your dealer does not carry Magic Tack Rags, write us for sample.

Edmont Rubber Gloves

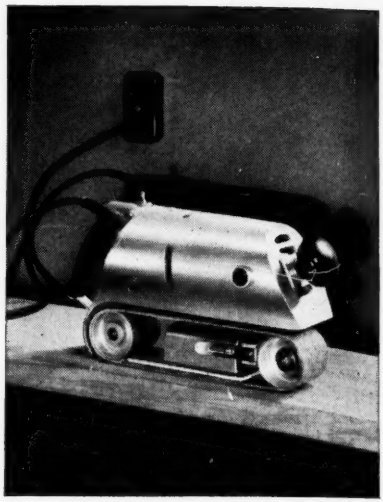
Work gloves that are made of fabric which is rubber coated on the face side only have been placed on the market by Edmont Manufacturing Co., Edmont St., Coshocton, Ohio. The rubberized work gloves are made of fabric and the rubber is bonded to the fabric on the palms, face and tips of the fingers. The backs of the fingers and the back of the glove itself are untreated to provide ventilation.

The rubber coating is said to protect the glove against deterioration and offer a wear-resisting, water-proof covering for workers' hands. A range of sizes and styles are available.

GuildSander

A portable electric belt sander which is said to bring new speed, efficiency and convenience to metal finishing operations has been placed on the market by Syracuse GuildTool Company, Syracuse, N. Y., in the form of a nine-pound portable electric belt sander, to be known as the "GuildSander," Type A-2. This sanding unit which features compactness was especially designed for the workman who desires a belt type sander for sanding, surfacing and refinishing operations.

The GuildSander is light in weight and operates in any position. It is said to have the power to do all types of sanding and the adaptability to sand all straight or slightly curved surfaces. The front pulley is adaptable as a spindle sander. Where paints, varnishes and other surfacing materials have to be removed, the GuildSander is said to be a time and labor saver.



GuildSander

The GuildSander is built with a die-cast aluminum frame, finished in baked aluminum enamel. The abrasive belts are of the endless type, and travel 600 ft. per minute. The belts are 2 in. wide and 21 in. in length, and are furnished in all usable grits. The belts may be changed completely by means of a patented catch and release spring plate.

The GuildSander is equipped with a 110-volt universal motor that plugs into any light socket, either A.C. or D.C.

Sellstrom Industrial Goggle

An industrial goggle for wearers of precision lenses to be known as the "Fit-Over Goggle No. 225" has been placed on the market by Sellstrom Manufacturing Co., 615 N. Aberdeen St., Chicago, Ill. This device consists of

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PROVIDES A FIRM, LASTING BOND BETWEEN METAL AND PAINT.
Use Metalprep to clean and prepare all sheet metal surfaces before painting. Removes rust and grease.
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Sellstrom Industrial Goggle

hinged frame goggles that fit over precision glasses and swing up out of the way without removing headband and without disturbing the regular glasses. For workmen who are required to wear corrective glasses and require protection from injury to eyes and lenses, the Fit-Over Goggle is available in sizes large enough to fit over the regular glasses and at the same time can be held firmly in place.

The frame of the Fit-Over Goggle is constructed of light weight material attached to a headband by double hinges that permit the goggles to be pushed forward and up. The headband is attached to a fabric cap that allows the band to be adjusted loosely for comfort, thus the weight is distributed evenly.

Airvulc Coating Material

Self-Vulcanizing Rubber Co., 605 W. Washington Ave., Chicago, Ill., is now marketing a liquid rubber coating material which can be applied like paint for metal surface protection. This material is marketed under the trade name of "Airvulc."

This material can be used as a priming material or as a bonding agent between an outer rubber coating and the metal surface to be protected. Application of both primer and final coating is by brushing, spraying or dipping. The primer coating is said to dry in one hour and is resistant to maximum temperatures of 212 degrees F.

Airvulc will not chip, crack, peel or blister with temperature changes below 212 degrees and is said to have a covering capacity of 200 sq. ft. per gallon, depending upon the nature of the surface being coated.

Additional coatings can be applied to build up the surface to any desired thickness. Each coating requires approximately one hour to dry. The finished coating protects the surface against abrasion and corrosion.

Uni-Wash Dust Collector

A dust collector for removing dust, fumes and vapor from the atmosphere to be known as "Uni-Wash" has been placed on the market by D. H. Baird Co., 9141 Central Ave., Detroit, Mich. This unit is designed for installation at grinding and polishing machines to remove dust. Inlet connections to the Uni-Wash unit are made at one or more downward pointing inlets to a center section. Thus, initial movement of the dust or fume-laden air is in the downward direction. Inside the Uni-Wash, the air impinges upon a body of water which is held in a reservoir where an initial separation is said to take place. The air and remaining moisture or fumes are then forced upward by means of a blower which forms the upper part of the assembly. In the upward passage of the air through the center chamber, it is subjected to water spray and then forced through a revolving moisture eliminator so that only clean, dry

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ALWAYS DEPENDABLE

"INDIAN BRAND" Turkish Emery cuts cleaner and faster because each step in grading and cleaning is checked and rechecked several times for perfection. It lasts longer because it's made only from the finest grades of ore.

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CHESTER MASSACHUSETTS

air issues from the blower delivery opening at the side near the top.

The drive of the Baird Uni-Wash in the standard unit is by V-belt connection to a vertically mounted motor on the side of the housing. Collected dirt in the bottom section of the unit is removed in the form of sludge through a covered opening which is provided for this purpose. The design of the Uni-Wash provides air ratings from 300 to 2,500 cubic feet per minute. The blower shaft rides on two Fafnir cartridge type ball bearings. Zerk fittings are provided for lubrication.

Ohio Floor Material

A floor material in tile or sheet form with an abrasive bonded in rubber has been placed on the market by Ohio Rubber Company, Randall St., Willoughby, Ohio. Slipping is said to be prevented on the floor material by the use of aluminum oxide abrasive bonded into the rubber service.

The material is available in tile and sheet form, absorbs noise, and is comfortable to stand or walk on. Ohio Floor Material can be applied on new or old floors of wood, concrete, marble, or steel, with a cement which is supplied.

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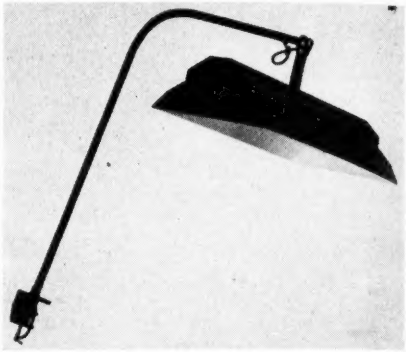
✓ The SAMUELS

Fostoria Fluorescent Type Canopy Localite

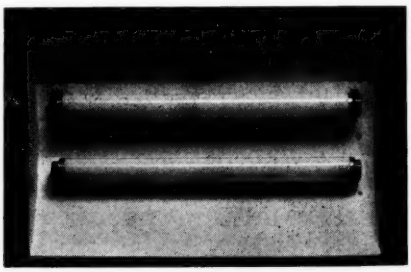
The Fostoria Canopy Localite, made by The Fostoria Pressed Steel Corporation, Fostoria, Ohio, is now available in



Fostoria Fluorescent Type Canopy Localite

five models. All use the same canopy and the same lamp assembly shown in the illustrations, and each is equipped with all necessary wiring, sockets, and auxiliary switches for installation of the two 18-in., 15-watt fluorescent lamps used in each Localite.

The canopy used in all models is 13¼ in. wide, 20 in. long, and 5 in. deep. It contains two magnetic switches and two sockets which will accommodate either of the two diameters in which these



Inside View of Model FA Fostoria Localite Lamp

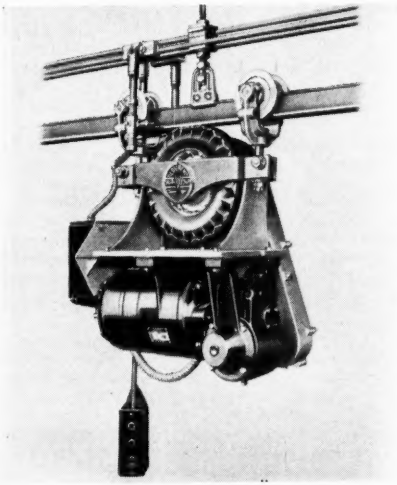
lamps are now available. The models are as follows: Model FA for overhead installation, Model 74-FA-121 for bench or table installation, Model 74-FA-122 for bench or table installation, Model

74-FA-128 for portable floor installation, and Model FA-138 for trolley truck installation.

The fluorescent lamp is an electrical discharge device which makes use of the ultra-violet energy from a mercury vapor arc to activate a fluorescent material coating on the inside of the tube surface. The lamp is now being used in those places in industry where special lighting is required for unusually fine work.

Louden Motoveyor

The Louden Motoveyor illustrated is the latest development of the Louden Machine Company, Fairfield, Iowa, in



Louden Motoveyor

power equipment for automatically transporting loads by means of an overhead track system. The Motoveyor will negotiate inclines and maintains uniform speed when going down grade. A range of speed of from 60 to 600 ft. per minute is available and movement is said to be smooth, quick and steady.

The simplicity and efficiency of the Louden Motoveyor lies in the fact that a rubber tire is utilized for the drive wheel. The drive shaft is supported in precision ball bearings located on each side of the wheel. The main frame is cast in one piece and the motor is mounted under the frame. The unit is perfectly balanced without the need of counterweights. The Motoveyor may be built into a cab or step-on platform so that the operator can accompany loads if desired and may also be used in power driven cranes.

No Rust Liquid V-15

A formulation of an anti-rust preparation, to be known as "No-Rust Liquid V-15," has been developed and is now being marketed by Frost Paint & Oil Corp., 1209 N. E. Tyler, Minneapolis, Minn. This product is recommended for protecting polishing steel parts of machinery and tools against rust in storage and during shipment.

No-Rust Liquid V-15 is easily applied with a brush or spray gun, and requires no mixing or special preparation. It dries in 30 minutes to form a tough, elastic, non-porous film which resists abrasion, moisture and salt air. The protective coating is readily removed by wiping with gasoline or kerosene when the machine is placed in service.

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To obtain copies of the catalogs listed here, indicate on the coupon the number of the item in which you are interested and mail as directed.

1. Profit With Paasche Air Painting Equipment
A 48-page catalog containing more than 300 photographic illustrations, listing and describing all that is latest and new in air finishing. Paasche Airbrush Co., 1910 Diversey Parkway, Chicago, Ill.

2. Kryolith
An 8-page folder describing Kryolith for use as an opacifier and fluxing agent in the enamel and ceramic industries. Pennsylvania Salt Manufacturing Co., Widener Bldg., Philadelphia, Pa. See page 11.

3. Miller Buffing Compositions
An excellent folder describing and illustrating buffing compositions for every kind of metal finishing manufactured by J. C. Miller Company, 528 Lake Michigan Drive, N. W., Grand Rapids, Mich.

4. Pangborn "Dust Hog"
A folder describing the detrimental effects of dust and the means of control of dust in the finishing plant or department. Pangborn Corporation, Hagerstown, Md.

5. Methods of Temperature Control
An interesting discussion describing specifications of instruments for controlling temperates from minus 100 to 1,400 degs. F. Burling Instrument Company, 241 Springfield Ave., Newark, N. J.

6. Corrosion Prevention
A 45-page bulletin dealing with corrosion problems and methods of solving them. Alox Corporation, Niagara Falls, N. Y.

7. Equipment Designs For the Pickle House
A 24-page booklet containing photos, sketches and data and full of practical "how-to-do-it" information. The International Nickel Company, Inc., 73 Wall St., New York, N. Y.

8. Crawford Industrial Ovens
Many types of ovens are illustrated and described in this new 44-page catalog. American Machine & Foundry Co., Crawford Oven Division, 200 Shelton Ave., New Haven, Conn.

9. Sterling Speed-Bloc Sanders
A profusely illustrated and informative 16-page catalog describing Sterling Speed-Bloc Air Driven Sanders is now being issued by Sterling Products Company, 303-V Donovan Bldg., Detroit, Mich.

10. Newcomb - David Metal Finishing Equipment
Supplement A-10 is the designation of the new catalog describing spray booths, industrial ovens and metal parts washers now being manufactured by Newcomb-David Company, Inc., 5741 Russell St., Detroit, Mich.

11. pH Meter
Two models of the Beckman pH meter, one for the laboratory and one for industrial use, are fully described in a bulletin now being issued by Arthur H. Thomas Company, E. Washington Square, Philadelphia, Pa.

12. Washing Machinery
A useful catalog that has been issued by G. S. Blakeslee & Co., 19th St. and 52nd Ave., Cicero Station, Chicago, Ill., illustrating many types of metal and parts washers in the Blakeslee line.

13. Satin-Black Penetrating Finish
A 4-page folder describing Pentrate, a penerating process paint which provides a means of applying an attractive, low-cost black finish to steel through chemical action. Heatbath Corporation, Springfield, Mass.

14. Viscosity Tubes
An 8-page folder describing the air bubble method for determining the viscosity or body of varnishes and lacquers and the equipment necessary for this type of test. R. P. Cargille, 118 Liberty St., New York, N. Y.

15. Finishing Department Maintenance
A 4-page folder describing the manner in which the use of Arco paint in maintenance work aids in efficient maintenance painting. The Arco Company, 7301 Bessemer Ave., Cleveland, Ohio.

16. Portable Electric Tools
One of the most complete catalogs on Skilsaw Portable Electric Tools for production, maintenance, and construction. Skilsaw Inc., 5033 Elston Ave., Chicago, Illinois.

17. Reference List of ACP Products
A 4-page folder which can be used as a handy reference table of chemicals and processes marketed by American Chemical Paint Company, Ambler, Pa. See page 45.

18. Tumbling Equipment
A new bulletin giving information on tumbling equipment and tumbling compounds for metal-finishing in mass production. Lupomatic Tumbling Machine Co., Inc., 4510 Bullard Ave., New York, N. Y. See page 52.

19. Industrial Ovens
A method whereby oven costs can be reduced, the production improved and oven operations accelerated is described in the 4-page catalog now being issued by The Kirk & Blum Manufacturing Co., 2816 Spring Grove Ave., Cincinnati, Ohio. See page 29.

20. Spray booths and ovens
Newcomb-David Company, Inc., 5741 Russell St., Detroit, Mich., has issued a 24-page catalog illustrating and describing typical N-D Spray Booths, Industrial Ovens, Metal Booths, Washers and Ventilating Equipment.

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